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INTERNATIONAL PETROLEUM ENCYCLOPEDIA

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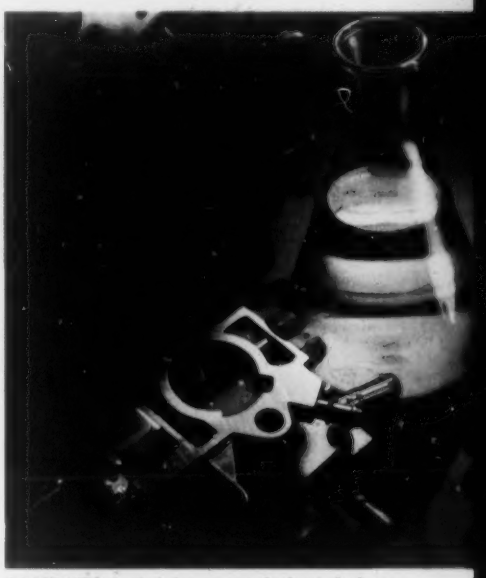
Table 1

Possible scenarios for world oil prices*

	Estimated		Projected			Compounded average annual % change	
	1985	1988	1990	1995	2000	1990-95	1995-2000
			U.S. $/bbl				
LOW PRICE CASE							
Current dollars	27.53	13.32	12.00	16.00	22.00	5.9	6.6
1988 dollars	30.21	13.32	11.00	11.80	13.04	1.4	2.0
Inflation index	91.13	100.00	109.20	135.43	168.77	4.4	4.5
Probability (%)	—	—	15	15	10	—	—
BASE CASE							
Current dollars	27.53	13.32	15.00	22.00	30.00	8.0	6.4
1988 dollars	30.21	13.32	13.48	15.41	16.16	2.7	0.9
Inflation index	91.13	100.00	111.30	142.73	185.66	5.1	5.4
Probability (%)	—	—	60	70	80	—	—
HIGH PRICE CASE							
Current dollars	27.53	13.32	21.00	28.00	40.00	5.9	7.4
1988 dollars	30.21	13.32	18.37	19.10	19.83	0.8	0.7
Inflation index	91.13	100.00	114.30	146.57	201.76	5.1	6.6
Probability (%)	—	—	25	15	10	—	—

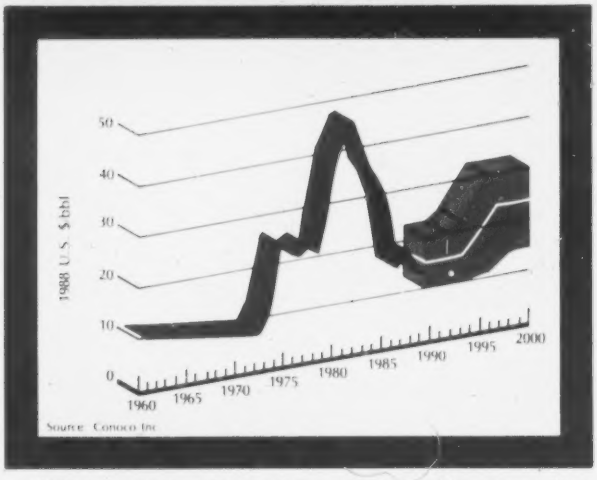
*Spot price for Arab light at Rotterdam.

Source: Ashland Oil Inc.



FORECASTS took into account slow—but relentless—economic growth in many parts of the world.

Where crude oil prices are headed



tighter markets, prices will be constrained by competition from oil and other fuel substitutes.

Coal will continue to compete with oil and gas in new boilers, but changing environmental standards make the outlook uncertain, Conoco said. Nuclear power growth will be limited by construction costs and safety concerns. Hydroelectric power will be the only renewable energy source to significantly increase its contribution to energy supplies, although limited to select areas.

An eventual decline in non-OPEC oil production, along with steady demand growth, will lead to a growing dependence on OPEC oil in 1990-2000, Conoco predicted (Fig. 2).

By the early 1990s, demand for OPEC oil will reach 22 million b/d, or about 80% of 1989 capacity, and OPEC may be able to regain control of world oil markets at that time. As demand increases and producing countries outside Middle East OPEC members reach capacity, incremental supply requirements will be met by Middle East exporters.

Conoco said, "These exporters will have two options as capacity utilization rises: increase production capacity or increase prices. If they have learned a lesson from the mistake of letting prices rise too quickly in the past, they will raise capacity sufficiently to put a cap on the price of oil at a level well below the previous high."

Conoco pointed out that most of the non-OPEC production increases of the 1970s arose from giant discoveries in the North Sea and Mexico. Gains in the 1980s were from many smaller discoveries in countries such as Egypt, Malaysia, Brazil, India, Angola, Colombia, and North Yemen.

The company predicted a continued slide in U.S. oil production. That's due in part to a lack of access to prime frontier areas such as the Coastal Plain of the Arctic National Wildlife Refuge in Alaska.

Non-Communist oil demand will increase to 58 million b/d in 2000 from 48 million b/d in 1987, Conoco said. U.S. demand, meantime, will rise to 19.5 million b/d from 16.7 million b/d.

The fastest growth in oil demand will be in developing nations, mainly in the Pacific basin.

Among developed nations, demand will increase 1%/year, mainly in transportation. Oil demand in developed nations, however, will be lower in 2000 than in the peak year of 1979.

Gasoline consumption in the non-Communist world will increase 1.5%/year. Continued growth in air travel will boost kerosine jet fuel consumption 2.5%/year.

In the U.S., gasoline consumption will grow 1%/year, while kerosine jet fuel demand will grow 2.5%/year.

Additional non-Communist refining capacity to upgrade heavy fractions of the barrel will be required in the 1990s because of higher light product requirements and increases in heavy oil production.

In the U.S., oil imports will increase to 55% of total supply by 2000 from 37% in 1988 (Fig. 3).

Non-Communist total energy demand will grow to 135 million b/d of oil equivalent in 2000 from 108 million b/d in 1988, which is about the same growth rate of 1970-88, Conoco said. In the U.S., energy demand will grow 1.5%/year, about half the expected rate of economic growth.

Nearly half of non-Communist energy demand growth will occur in developing nations where growing populations and increasing urbanization and industrialization are stimulating

Table 2

Non-Communist oil demand at different prices*

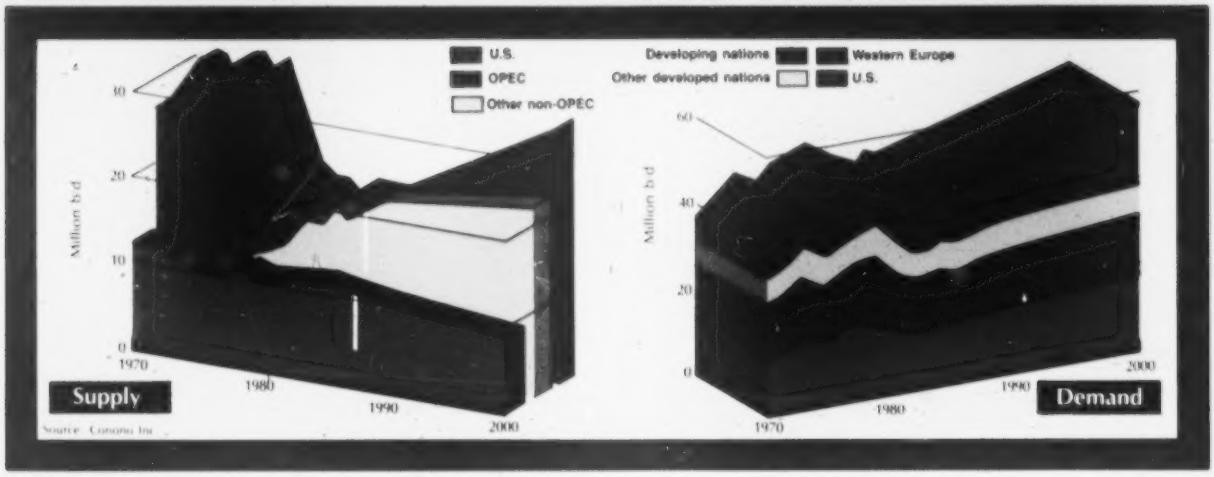
	Low price case			Base case			High price case		
	1990	1995	2000	1990	1995	2000	1990	1995	2000
	Million b d								
Industrialized nations	37.9	39.6	40.2	37.2	38.2	38.2	35.8	35.2	34.4
OPEC members	3.3	3.6	4.1	3.3	3.5	3.9	3.4	3.5	3.8
Non-OPEC	10.7	12.8	15.1	10.4	11.7	12.4	10.3	11.3	11.8
Total	51.9	56.0	59.4	50.9	53.5	54.5	49.5	50.0	50.0
Average growth 1990-1995 (% year)			1.5			1.0			0.2
Average growth 1995-2000 (% year)			1.2			0.4			0.0

*As specified in Table 1.

Source: Ashland Oil Inc.

A CONTINUED slide in U.S. oil production is predicted.

What lies ahead for non-Communist oil 2



energy consumption. Developing nations accounted for less than one fourth of non-Communist energy demand in 1989.

Ashland's view of prices, demand

Ashland based its oil demand forecast of October 1989 on three price cases hinged to a most likely outlook for a range of $13.48-16.16 bbl in constant 1988 U.S. dollars during 1990-2000. It pegged the probability of that case at 60-80% (Table 1).

Ashland also assessed a low price case of $11-13.04 bbl and a high price case of $18.37-19.83 bbl, placing those probabilities at 10-25%.

Prices, Ashland said, will determine the volume of non-Communist oil demand within a projected range of 50-59.4 million b d in 2000 (Table 2).

Most analysts have toned down their projections of rising oil demand, Cyrus H. Tahmassebi, Ashland chief economist, told a Repsol-Harvard University energy seminar at Toledo, Spain, in April 1988.

"Unless the price remains below $15 bbl for an extended period, almost all of the current forecasts of demand for OPEC oil will prove to be on the optimistic side," Tahmassebi said.

That's because the pace of world economic growth in 1988-95 will be significantly lower than expected—about 1.5-2% year rather than 2.5-3% as many analysts assume.

What's more, Tahmassebi said, demand for oil will grow at a rate less than the 1.5-2% year projected by many analysts.

This will happen not only because of lower than expected economic growth rates but also because of such diverse factors as excise taxes or tariffs on oil in some of the major consuming countries, technological breakthroughs, increasing competiton from natural gas and coal, and expectations of higher prices. It is true there is a potential for significant increases in demand for oil in developing and newly industrialized countries, Tahmassebi said. But this potential can be realized only if commodity prices move upward, new loans are made available to debtor nations, world trade continues to expand, and newly industrialized nations do not resort to added tariffs and taxes on imported oil.

Such tariffs and taxes are important to OPEC members because of the outlook for a rebound in their share of the non-Communist oil market in 1990-2000. Ashland's October 1989 forecast sees OPEC production of 20-28 million b d accounting for 39-51% of non-Communist oil demand in 1990-2000 under the most likely price scenario (Table 3).

IEA's long term energy outlook

The U.S. Energy Information Adminstration's 1989 international energy outlook projects world oil prices to remain at

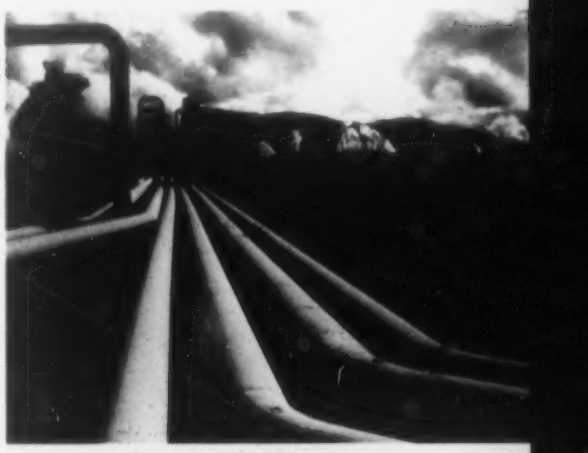
Table 3

OPEC's role in non-Communist oil supply

	Actual			Base case scenario projection*		
	1979	1985	1988	1990	1995	2000
	Million b d					
Non-Communist production	51 9	46 2	50 1	50 9	53 5	54 5
OPEC production	30 9	16 0	19 3	20-21 3	22 5-24 9	25 5-28
OPEC productive capacity	34 0	30 0	26 0	30 0	32 0	35 0
OPEC production market share (%)	60	35	39	39-42	42-47	47-51
OPEC operating rate (%)	90	53	75	67-71	70-78	73-80

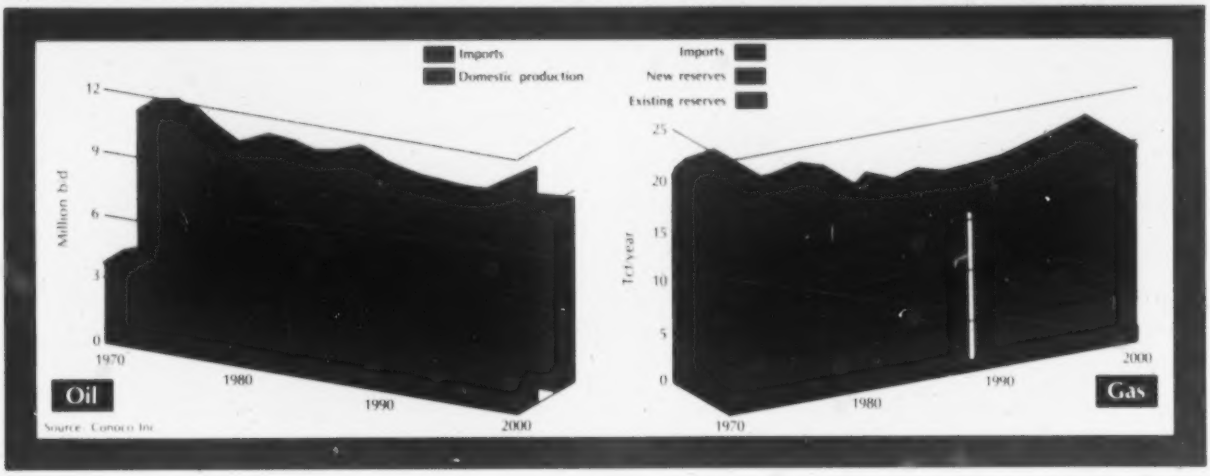
*As specified in Table 1.

Source: Ashland Oil Inc.



NON-COMMUNIST OIL DEMAND will increase to 58 million b/d in 2000 from 48 million b/d.

How the makeup of U.S. supply could change



less than $20 bbl in real terms until the mid-1990s, when reductions in excess productive capacity will allow moderate price increases (Fig. 4).

In EIA's low price case, prices could remain below $22 bbl through 2000.

Prices could easily vary within EIA's projections for any particular year, the agency said. But there is no way to determine how variations will take place.

"To date," EIA said, "OPEC has not exhibited the type of restraint necessary to stabilize prices. Until this restraint is applied consistently, price variation will likely be the norm."

The agency based its price projections on the assumption of a moderate increase in oil demand in the "market economies" between 1987 and 1995 of about 5 million b/d and little increase after that as oil prices rise.

It defined the market economies as all countries other than the centrally planned economies of eastern Europe, the Soviet Union, China, Cuba, Kampuchea, North Korea, Laos, Mongolia, Viet Nam, and Yugoslavia.

EIA cautioned, "These forecasts are not meant to convey the impression that the world oil market will be stable but rather to indicate a likely range of prices over the foreseeable future.

"Within this range no one price level is more likely than another. It is clear, given recent history, that prices could well vary considerably within this range on a year to year basis."

However, EIA said, some fundamental market realities are likely to prevail:

• The longer prices remain at the low end of the range—everything else being equal—the more likely they will tend to be higher later in the projection period. Conversely, higher prices in the near term could moderate price increases in later years.

• It is likely that oil prices and economic growth will continue to be the driving factors behind changes in all energy markets as other fuels attempt to compete with oil.

EIA called "instability" the prime characteristic of the world oil market in 1988 as OPEC's internal problems led to overproduction by many members. That, in turn, set off a rapid decline in price.

The 1988 experience was the second time in 2 years that prices showed extreme variation and may be an indicator of the state of the oil market for the next several years, EIA said.

In 1986, Saudi Arabia, which tried to regulate prices by acting as the "swing producer" in OPEC, responded to continued overproduction by some members by increasing

Table 4

How EIA sees oil production capacity*

	Estimated 1988	Projection ranges 1990	1995	2000
	Million b d			
U.S.	10.6	9.8-10.2	8.4-9.4	7.8-9.1
Canada	2.0	1.9-2.1	1.6-1.8	1.4-1.6
Mexico	2.9	2.9-3.1	3.1-3.4	3.1-3.5
North Sea	3.9	4.0-4.3	3.4-3.9	2.9-3.4
Other non-OPEC	8.1	8.4-9.2	7.4-8.5	6.0-7.2
Total non-OPEC	**27.5**	**27.2-28.6**	**24.3-26.6**	**21.6-24.3**
Algeria	1.2	0.9-1.1	0.9-1.1	0.7-0.9
Ecuador	0.3	0.2-0.3	0.2-0.3	0.2-0.3
Gabon	0.2	0.2-0.3	0.2-0.3	0.1-0.2
Indonesia	1.5	1.4-1.5	1.2-1.4	1.0-1.2
Iran	3.0	3.0-4.0	3.5-4.5	3.5-4.5
Iraq	2.7	3.5-4.5	4.0-5.0	4.5-5.5
Kuwait†	2.5	2.8-3.0	3.0-3.5	3.0-3.8
Libya	1.6	1.5-1.7	1.3-1.7	1.3-1.7
Nigeria	1.7	1.5-1.7	1.2-1.6	1.1-1.5
Qatar	0.6	0.5-0.6	0.4-0.6	0.3-0.5
Saudi Arabia†	8.5	8.0-9.5	9.0-10.5	9.5-11.0
United Arab Emirates	2.0	2.0-2.2	2.2-2.6	2.5-3.0
Venezuela	2.4	2.4-2.6	2.5-2.9	2.5-3.0
Total OPEC	**28.2**	**28.6-32.3**	**30.6-35.0**	**31.3-36.0**
Net Communist exports	2.4	2.2-2.7	1.4-2.4	1.0-2.0
Total market economies	**58.1**	**58.8-62.7**	**57.7-62.7**	**55.4-60.9**

*Some columns don't add because of rounding. †Includes 50% of Neutral Zone capacity.

Source: Energy Information Administration

U.S. DEMAND will rise to 19.5 million b/d from 16.7 million b/d.

its own oil flow. As a result, prices plunged to less than $10 bbl briefly for some types of crude oil.

Again in late 1988, overproduction by some OPEC members led Saudi Arabia to increase its production, and prices again fell dramatically.

EIA said, "As long as OPEC as a whole or any dominant producer within OPEC is unwilling to adjust production to stabilize prices while excess productive capacity exists, it is likely that wide variations in prices will continue."

OPEC has had a hard time controlling production because it is composed of countries with widely divergent social and economic problems and interests, EIA pointed out. It is this diversity of social, political, and economic situations that makes it difficult to establish and hold to a production policy.

For example, some countries such as Saudi Arabia have extensive oil reserves that will last well into the next century at 1988-89 production rates. Given that fact, Saudi Arabia wants to maintain production and prices in a manner that will guarantee a market for its oil over the long run.

Other OPEC members with smaller oil reserves—among them Algeria, Libya, and Indonesia—are more interested in receiving higher prices in the near term.

Supply disruption's effect on prices

The growing concentration of oil reserves and production in the Middle East—especially around the Persian Gulf—is not only likely to exert upward pressure on oil prices but also could increase the potential for a serious disruption in oil supplies, EIA warned.

A 6 month closure of the Strait of Hormuz beginning Jan. 1, 1995, could kick up oil prices to almost $50 bbl in 1988 dollars, EIA said (Fig. 5).

This hypothetical disruption, although considered by EIA to be highly unlikely, could result in a net loss of about 10 million b d even after allowing for the use of excess productive capacity and a surge in exports via alternative pipeline routes out of the Persian Gulf region.

EIA's example assumes that the U.S. reponds to the disruption by drawing down its Strategic Petroleum Reserve at maximum rates at the same time that other countries in the market economies draw down their government controlled stocks. The anticipated price spike of $10-33 bbl depends on what is assumed about commercial inventory behavior and the responsiveness of demand to price increases—elasticity of demand. The wide range of uncertainty reflects substantially different ways in which the market may respond to an oil supply disruption, EIA said.

If suppliers and end users draw down commercial inven-

IEA's view of world oil prices* 4

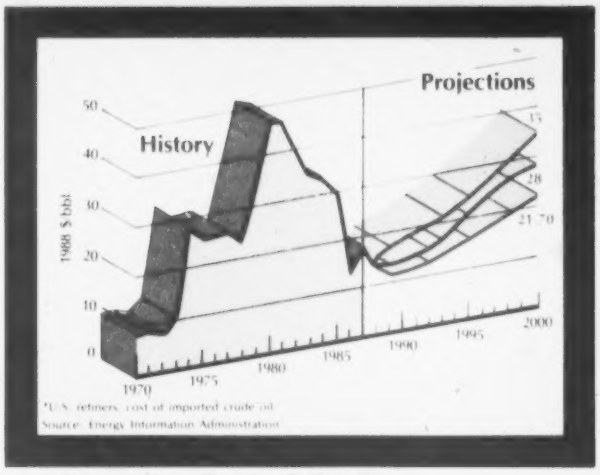


Table 5

A sampling of 1988's 5 year oil price forecasts*

Company	Forecast date	($ bbl) 1989	1990	1991	1992	1993
Brokerage/Investment Co. A	July	16.80	20.25	21.55	23.00	24.45
Brokerage/Investment Co. B	July	18.00	19.00	20.50	22.50	25.00
C.C. Pace Corp.	Oct.	16.55	19.45	20.87	22.40	24.05
Independent Oil Co. A	Nov.	15.50	17.00	18.50	19.50	20.50
Independent Oil Co. B	Nov.	15.70	17.35	19.00	20.00	21.00
Independent Oil Co. C	Nov.	15.50	16.25	17.75	19.75	22.00
Major Bank A	Nov.	15.00	15.75	16.54	17.36	18.23
Major Bank B	Nov.	14.00	14.00	14.43	15.15	15.91
Major Oil Co. C	Nov.	17.09	18.20	19.38	20.04	21.99
Major Oil Co. D	Aug.	18.00	19.00	21.00	23.00	25.00
Major Oil Co. E	Nov.	16.06	16.70	17.39	18.13	20.37
Major Oil Co. F	Nov.	15.50	16.50	18.50	21.00	23.00
Major Oil Co. G	Aug.	17.78	17.82	18.85	18.89	19.65
Oil & Gas Journal	Nov.	18.50	18.50	19.75	21.50	22.50
PaineWebber	Dec.	15.00	16.00	18.00	19.00	20.00
Pipeline Co. A	Nov.	16.00	17.00	19.00	21.00	24.00
Pipeline Co. B	Nov.	21.22	22.07	22.96	23.87	24.83
High		**21.22**	**22.07**	**22.96**	**23.87**	**25.00**
Low		**14.00**	**14.00**	**14.43**	**15.15**	**15.91**
Average		**16.60**	**17.70**	**19.06**	**20.36**	**21.91**
		(1987 $/bbl)				
Major Oil Co. C	Nov.	15.80	16.12	16.44	16.77	17.10
Major Oil Co. E	Nov.	14.93	14.93	14.93	14.92	16.12
Major Oil Co. G	Aug.	16.48	15.73	15.84	15.26	15.27
Major Oil Co. H	Nov.	15.80	16.20	16.20	16.70	17.20
Pipeline Co. A	Nov.	14.86	15.19	16.32	17.34	19.06
Pipeline Co. B	Nov.	19.72	19.72	19.72	19.72	19.72
High		**19.72**	**19.72**	**19.72**	**19.72**	**19.72**
Low		**14.86**	**14.93**	**14.93**	**14.92**	**15.27**
Average		**16.27**	**16.32**	**16.58**	**16.79**	**17.41**

*Annual average spot price for West Texas intermediate

Source: Oil & Gas Journal Energy Database Survey of Forecasters

Oil DEMAND in developed nations will be lower in 2000 than in the peak year of 1979.

tories in an effort to fill the supply gap while consumers reduce energy use in response to higher prices, the economic effects of the disruption will be dampened and prices will tend toward the lower end of the range.

On the other hand, if consumption remains close to predisruption levels while commercial inventories are built up in anticipation of future price increases caused by uncertainty over the disruption's size and duration, the economic effects of the disruption will be intensified and prices will tend toward the higher end of the range.

EIA found the aftermath of such a supply disruption "highly uncertain."

When oil supplies are restored, assumed to occur in third quarter 1995, world oil prices could fall below EIA's base case levels.

The agency said, "A cyclical pattern of price changes might then develop as a result of the continuing effects on oil demand in the postdisruption period, caused by past higher prices and reduced economic activity.

"The actual price levels described in this analysis are of less interest than this erratic pattern of price movements and its potential adverse effects on the world economy."

Excess capacity seen persisting

Barring a supply disruption, EIA sees continued downward pressure on oil prices because excess productive capacity will persist well into the 1990s in the market economies. Size of the excess will decline over time (Fig. 6).

EIA predicted the world market economies will see a rise in crude oil productive capacity from 58.1 million b d in 1988 to as much as 62.7 million b d in 1990 and 1995. Capacity could slip to 55.4-60.9 million b d in 2000 (Table 4).

Production capacity trends for non-OPEC nations will be mixed through the early 1990s, then steadily decline in the late 1990s. Capacity for OPEC members trends upward at the lower and upper ends of the projection range, with Saudi Arabia continuing to play its dominant role in production capacity.

EIA's projected near term increase in production potential in the non-OPEC countries comes mainly from the North Sea and the "other non-OPEC" group.

Despite the 1986 collapse in world oil prices, production from the other non-OPEC group of countries has been on the rise.

This continuing increase in production reflects a fundamental difference in production economics between this group and the rest of non-OPEC countries such as the U.S. and Canada, EIA said. In general, direct lifting costs in the U.S. and Canada are much higher than among other non-OPEC countries due to the age, size, and location of U.S. and Canadian oil fields.

Some of the non-OPEC oil being produced in 1989 was discovered in the early 1980s when the price of crude oil

Table 6

OPEC production capacities, preferred volumes

	1979 capacity	1988 Preferred output	1988 Current capacity	1990 Preferred output	1990 Sustainable capacity	2000 Preferred output	2000 Sustainable capacity
	Million b d						
Iran	7.0	2.5	2.8	3.0	3.5	4.0	4.0
Iraq	4.0	3.0	*2.7	3.0	4.0	4.0	5.0
Kuwait	3.3	1.25	1.7	1.3	2.2	2.0	3.0
Saudi Arabia	10.8	5.0	6.5	5.0	8.0	8.0	10.0
U A E	2.0	1.5	2.0	1.8	2.0	2.5	2.3
Qatar	0.6	0.5	0.5	0.5	0.5	0.6	0.6
Neutral Zone	0.6	0.5	0.5	0.5	0.5	0.5	0.5
Total Persian Gulf	**28.3**	**14.25**	**16.7**	**15.1**	**20.7**	**21.6**	**25.4**
Indonesia	1.8	1.3	1.3	1.3	1.3	1.0	1.0
Libya	2.5	1.3	1.4	1.5	1.7	2.0	2.0
Ecuador	0.2	0.31	0.3	0.4	0.4	0.4	0.4
Venezuela	2.4	1.9	2.5	2.0	2.5	2.5	3.0
Gabon	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Algeria	1.2	0.6	0.8	0.6	0.6	0.5	0.5
Nigeria	2.5	1.6	1.8	1.6	1.8	1.7	1.7
Total OPEC	**39.1**	**21.46**	**25.0**	**22.7**	**29.2**	**29.9**	**34.2**

*Iraq's production capacity is 3.5 million b d, exceeding total crude handling capacity of export facilities.

Source: East-West Center

OIL DEMAND growth will be limited by finances, environmental concerns, and business slowdown.

was still very high. Development of those discoveries required not only the drilling of wells but also establishment of infrastructure needed for distribution.

For example, Yemen Hunt Oil Co. and partners found oil in North Yemen in 1984, but there was no significant production there until late 1987 and in 1988. In this case, production lagged discovery by about 3 years.

Development of reserves discovered in the early 1980s should allow non-OPEC countries to increase production through the early 1990s, EIA said. But production will peak in 1993 or 1994, then begin a decline. That's because most of the existing proved reserves will be developed and new discoveries won't be able to replace production due to low oil prices and the resulting slow pace of exploration.

Analysts assess 1990s oil price outlook

Mindful of the disaster wrought by the 1986 oil price plunge, petroleum analysts were keeping a sharp watch on the outlook for prices in the 1990s.

A May 1989 survey of analysts by Oil & Gas Journal showed a rather wide range of forecasts through 1993. Predictions for that year ranged from $15.91 bbl to $25 bbl, averaging $21.91 bbl (Table 5).

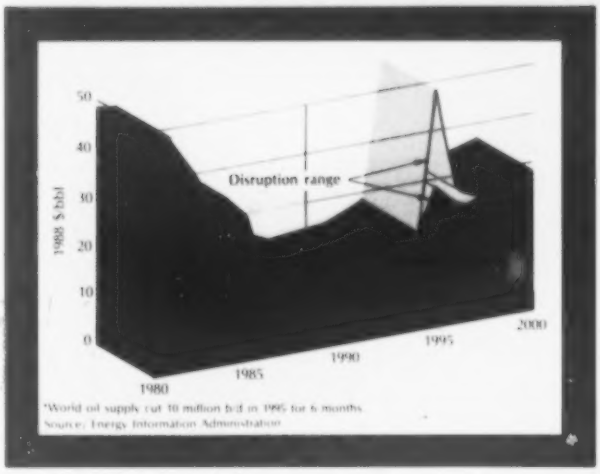
Based on that survey, the Journal asked, "Are oil prices headed for $40 bbl again? Or will West Texas intermediate spot crude plunge to less than $15 bbl again? Or will the price of oil simply track inflation the next 5 years?"

Such scenarios were among those being speculated as oil analysts spread across the prognosticating map in an effort to divine the direction of oil prices.

The Journal said the wild rollercoaster ride of oil prices since late 1985 had confounded forecasters, including those in OPEC, once thought to have an unshakable grip on oil prices.

Oil price forecasters did not have the most enviable track record before the 1986 price collapse. They had to contend with continuing mixed signals from OPEC—particularly linchpin Saudi Arabia—rethink fundamental assumptions about oil demand, and gauge the effect of an unprecedented string of non-OPEC supply disruptions, due mainly to accidents in the North Sea.

Supply disruption effect on oil price* 5



*World oil supply cut 10 million b/d in 1995 for 6 months.
Source: Energy Information Administration

Other ingredients were being added to that stew: social and political upheavals among Soviet bloc countries, campaigns for alternate fuels in the wake of public reaction to reports about acid rain, global warming from the greenhouse effect, air pollution, and oil spills, the changing geopolitical face of the Middle East, the guessing game over recession vs. inflation, and the prospect of a cheap, clean, inexhaustible source of energy as cold fusion breakthroughs were hotly debated.

There were other wild cards in the forecaster's deck, such as terrorism affecting travel, current weather patterns, changes in U.S. and state tax policy, and public attitudes toward the oil industry.

Underscoring the diversity among forecasters, one widely respected firm, C.J. Lawrence, Morgan Grenfell Inc., New

Table 7

OPEC crude production, exports, revenue*

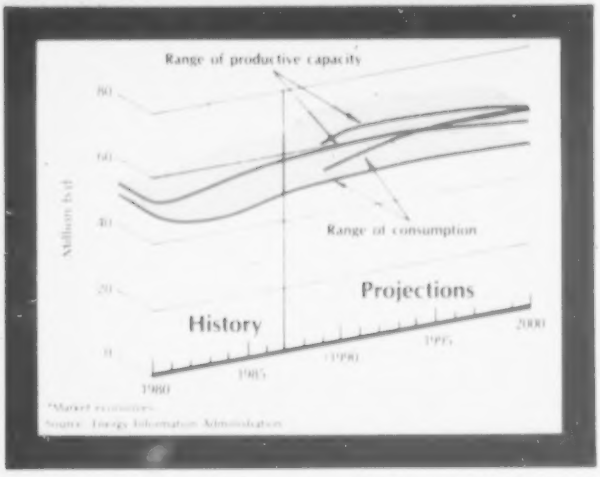
	Crude oil production		Crude oil exports		Crude oil export revenues	
	1987	1988	1987	1988	1987	1988
	1,000 b/d				Million U.S. $	
Algeria	648.2	650.7	165.0	168.0	6,057	4,988
Ecuador	180.9	300.8	105.3	149.8	724	976
Gabon	154.5	157.0	138.4	145.6	896	779
Indonesia	1,160.0	1,180.0	701.0	609.2	6,157	5,185
Iran	2,290.0	2,300.0	1,710.0	1,696.0	10,515	8,170
Iraq	2,360.0	2,740.0	1,717.0	2,095.0	11,416	10,952
Kuwait†	971.6	1,390.0	607.0	698.0	7,520	6,295
Libya	972.5	1,030.0	810.0	890.0	6,011	5,169
Nigeria	1,320.0	1,370.0	1,065.2	1,110.5	7,023	6,126
Qatar	291.4	319.4	254.0	304.0	1,829	1,709
Saudi Arabia†	3,970.0	5,090.0	2,416.5	3,354.8	19,271	20,500
U.A.E.	1,420.0	1,510.0	1,250.0	1,345.0	8,665	7,352
Venezuela	1,570.0	1,630.0	1,026.3	1,011.0	6,959	8,162
Total	**17,320.0**	**19,680.0**	**11,965.7**	**13,576.9**	**93,042**	**86,364**

*Some columns don't add because of independent rounding. †Includes 50% of Neutral Zone.

Source: OPEC secretariat

WORLD MARKET economies will see a rise in crude oil productive capacity.

How capacity, consumption compare* 6



York, published the disagreement between its two principal analysts on the future course of oil prices.

Given the widely divergent forecasts, there remained some underlying market fundamentals that suggested in the long term relatively low prices amid short term price spikes and nosedives. The disagreements among analysts rested largely on degree and duration of the volatile periods and what the average price of oil will be during the 1990s.

There was one area of agreement among analysts: No one was willing to predict a near term end to price volatility.

OPEC had been hurt as much as anybody by the price rollercoaster, especially since 1986. So it would seem logical that lessons have been learned and that a longer viewed self interest would prevail again, no matter what the wild price gyrations of the moment.

But the direction of oil prices had never been fully determined by logic.

So it followed that in speculating about oil prices, analysts acknowledged two casualties of forecasting: Certainty was history, and consensus was fading fast.

Verleger: Another oil crisis?

Philip Verleger Jr., visiting fellow for the Institute for International Economics, Washington, D.C., contended in summer 1989 that world oil markets were marking the 10th anniversary of the 1979 oil supply crisis with another crisis.

A combination of factors resembling circumstances in the 1979 oil crisis threatened to cause another steep spike in the price of crude oil and a return to lines at U.S. gasoline stations, Verleger said. He offered these snapshots of oil markets in 1979:

- Iran's oil production collapsed.
- Unconstrained demand was rising rapidly, largely because of unexpected strength in the world economy.
- Consuming nations pursued misguided policies.
- Intervention in gasoline markets caused shortages.
- Oil stocks on land held by private companies covered only 67 days of forward consumption in April 1979.
- Producing countries other than Iran announced random unilateral cuts in output.

And in 1989:

- Spot prices of light crude oils were ahead of the pace set during the 1979 crisis.
- Demand for petroleum continueed to stay strong, due mainly to surprising economic strength.
- Government policies were once more upsetting the delicate supply demand balance in critical markets.
- Oil stocks covered 70 days of forward consumption in April 1989.
- Supplies from critical exporting nations were being disrupted again.

Extrapolation from the 1979 crisis suggested that prices could continue to rise for another 12 months, with West Texas intermediate reaching $40 bbl, Verleger said.

"This extrapolation of prices seems extreme today and defies fundamentals. On the other hand, no one predicted in January 1979 that prices would rise to $40 bbl by the following December," Verleger wrote in Charles River Associates Petroleum Economics Monthly.

More likely, he said, was that the introduction of efficient commodity markets, particularly the New York Mercantile Exchange, would allow such a crisis to pass with more modest economic effects than the 1979 crisis.

Higher crude prices in 1979 took 3-4 months to reach the consumer because of the nature of crude price contracts

Table 8

How EIA sees the outlook for natural gas consumption

	History		Projections					
			1990		1995		2000	
	*1986	†1987	Base	Range	Base	Range	Base	Range
	tcf							
U.S.	16.2	17.1	17.9	17.9-18.2	18.9	18.7-19.1	20.3	20.2-20.6
Canada	2.0	2.0	2.1	2.1-2.2	2.6	2.5-2.9	3.0	2.8-3.3
Japan	1.5	1.6	2.5	2.5-2.9	3.1	2.9-3.7	3.6	3.2-4.5
OECD Europe	8.6	9.1	9.6	9.4-10.0	11.0	10.5-12.1	13.3	12.5-14.8
U.K.	2.0	2.2	2.6	2.6-2.7	3.1	3.0-3.3	3.4	3.3-3.7
France	1.1	1.1	0.8	0.7-1.0	0.8	0.5-1.2	1.2	0.8-1.8
W. Germany	2.0	2.1	2.0	1.9-2.1	2.2	2.0-2.5	2.6	2.3-3.0
Italy	1.3	1.4	1.4	1.4-1.5	1.6	1.5-1.8	1.9	1.7-2.2
Netherlands	1.4	1.4	1.4	1.4-1.5	1.6	1.6-1.7	1.8	1.7-1.9
Other Europe	0.9	0.9	1.3	1.3-1.5	1.7	1.6-2.1	2.3	2.1-1.8
Other OECD	0.6	0.7	0.7	0.7-0.8	0.9	0.9-0.9	0.9	0.9-1.0
Total OECD	**29.0**	**30.5**	**32.9**	**32.5-34.0**	**36.5**	**35.4-38.7**	**41.1**	**39.6-44.2**
OPEC	4.3	4.7	5.3	5.3-5.3	6.9	6.7-6.9	8.2	7.8-8.2
Other developing countries	3.7	4.2	5.4	5.2-5.7	7.9	7.4-8.8	10.3	9.5-11.7
Total market economies	**37.0**	**39.3**	**43.6**	**43.0-45.0**	**51.3**	**49.4-54.4**	**59.6**	**56.8-64.0**

*Actual. †Preliminary except for U.S., which is actual.

Source: Energy Information Administration

and price controls, Verleger noted. But in 1989, an increase in the price of crude in commodity markets caused an immediate change in the cost of much of the crude refined. And spot product price changes were quickly reflected at the pump.

Inflation's effect, U.S. energy security

One analyst quoted by the Journal cited inflation as the driving force behind oil prices' increasing moderately into the early 1990s.

Adjustments for inflation occur because oil contracts are denominated in U.S. dollars, and oil exporters try to maintain the purchasing power of their dollar denominated sales contracts, said Howard Bonham Jr., Underwood, Neuhaus & Co., Houston. He contended that inflation causes more than 50% of oil price fluctuations in the long term.

Bonham said the most important point about predicting oil prices the next 5 years is to recognize that oil prices will be restrained by enormous oil reserves and resources identified in the 1970s and 1980s, resulting in a worldwide reserve life of 42.26 years, the highest level since World War II.

He said, "The most cogent argument for rising prices is that demand growth for oil will exceed consensus long term forecasts of 1-2%/year, as it did in 1988...predicated on rapid development in Third World countries."

However, oil demand growth will be limited by finances, environmental concerns, and business slowdown, Bonham said.

The Journal quoted Charles Ebinger, senior associate at the Center for Strategic and International Studies, Washington, D.C., as saying that OPEC will take whatever measures necessary to ensure it recaptures lost market share—and that bodes ill for U.S. energy security.

"I am absolutely convinced that the government of Saudi Arabia and the government of Kuwait are absolutely hell bent on the fact that they are not going to let the oil price get away from them and away from OPEC once again," Ebinger told the Metropolitan Club in Englewood, Colo., in May 1989.

"Every conversation I have had (in the Middle East), I continue to hear the view expressed that $18 bbl is a ceiling, not a floor price, and I think that if in the very near future...the price remains above that level for any continued period of time, you're going to see production levels of at least those two countries raised to bring the price down to $15-18 bbl and to try to keep it there for 2-3 years.

"I think it is the considered policy of the government of Saudi Arabia and the government of Kuwait that the way to deal with their OPEC brethren is to keep the price down, see an expanding market and growing demand, and meet the revenue requirements of those countries less fortunate through an ever expanding market share for OPEC."

Noting government forecasts estimating U.S. imports in 1993 at 10.2 million b/d, or about 56% of total consumption, and growth in the Middle East and North Africa shares of those supplies, Ebinger warned of a return to heavy dependence on oil from politically unstable areas.

Fueling that rising oil demand will be the shortfall of electric generating capacity in the U.S., he said. Opposition to new nuclear and coal power plants and a lack of deliverability of natural gas will force utilities to burn more oil.

"I believe there may be a lot of natural gas in this country at prices of $2.50 Mcf and upwards. But I have real doubts that we're going to have prices of $2.50 Mcf or higher at the wellhead any time soon. This worries me because if OPEC keeps the price of oil at the level that I think they're going to move it back to...all of a sudden, people are going to be very surprised at what happens to natural gas deliverability the first time it is really tested."

OPEC loses production capacity

Most members of OPEC, especially those in the Persian Gulf region, have lost oil production capacity in recent years. In many cases, capacity declines were voluntary and reversible, said a 1989 report to the U.S. Department of Energy by East-West Center, Honolulu.

"Just as oil consumers have lost interest in future oil

U.S. refiners' projected environmental spending in the 1990s

	Million $/year
Near term	
Underground tanks	210
Landfarming refining wastes	106-600
Listing refining wastewater treating sludge as hazardous	2,000
Right to know reporting	55-75
Gasoline volatility pressure limits	1,500
Prevention of significant deterioration for NOx	1-100
Corrective action under RCRA for solid waste disposal facilities	300-800
Superfund spending under Cercla in excess of Superfund tax	9,000
Subtotal	**13,173-14,285**
Probable near term	
Diesel fuel 0.05% sulfur limit	1,200
Gasoline minimum oxygen requirements	15-200
New benzene emissions limits	Not estimated
New reasonably available control technology for VOC, NOx	3,970
New refinery effluent guidelines	Not estimated
New transportation-related requirements	Not estimated
Management of used oil under RCRA	Not estimated
Subtotal	**5,185-5,370**
Possible long term	
Acid rain sulfur dioxide	100-2,000
Toxic air pollutants	45-220
Offshore air emissions	170
Added Stage II vapor controls	200
Methanol fuels	Not estimated
Aboveground tanks	Not estimated
Waste minimization	Not estimated
Offshore effluent guidelines	Not estimated
UIC rules on production wastes	Not estimated
RCRA rules on solid production wastes	Not estimated
Global warming greenhouse effect legislation	Not estimated
Subtotal	**550-2,590**
Total excluding items not estimated	**18,873-22,245**

environmental concerns before the solutions—sometimes the wrong ones—are made for them.

In addition, some companies see new business opportunities in the field of environmental services and are scrambling to pursue them as separate profit centers.

Industry has long placed a strong emphasis on environmental and related issues.

But the explosion of media focus and public concern against the backdrop of "the year the earth spoke back," the Exxon Valdez oil spill, and a string of upstream and downstream disasters taking hundreds of lives and causing billions of dollars in damage in recent years have led many companies to stop and take stock of how they approach environmental matters.

A key move among many companies is to high grade responsibility for the environment within the corporate structure.

Exxon created the post in January 1990 of vice-president, environment and safety.

Exxon appointed one of its top executives, Edwin J. Hess, former senior vice-president of refining marketing, to the job. He reports directly to the president.

In the weeks preceding the appointment, an explosion at Exxon's Baton Rouge, La., refinery killed two persons, and an Exxon pipeline leaked more than 10,000 bbl of heating oil into New York Harbor.

For a company that had spent more than $1 billion in 1989 to rectify an environmental disaster—the Exxon Valdez spill—which was the most galvanizing single influence on the new environmental consciousness, Exxon's move is a sign of the times for the 1990s.

Changes needed

Concern for the environment is going to dominate the petroleum industry's agenda in this decade and beyond, industry officials agree.

That is reflected in recent committee work at the American Petroleum Institute, said Terry Yosie, API vice-president of health and environmental affairs.

An API task force chaired by Conoco Inc. Pres. C.S. Nicandros looked at the the challenges facing the petroleum industry in the 1990s.

The first and dominant issue quickly became apparent: the environment.

"Out of that task force came the conclusion that we needed a kinder, gentler API," Yosie said.

"There is a great difference in the perceptions of what the industry's goals are and the way society is going.

"That is an untenable position. We needed to set a new tone, a new direction."

The problem that the Nicandros task force pinpointed is targeted for solution by a new API task force, one chaired by Phillips Petroleum Co. Chairman Pete Silas.

The goal of the Silas environmental strategy task force is how to input long term planning processes and codify industry thinking on such issues as waste reduction and how to assess the Valdez principles, Yosie said.

The Valdez principles are a loosely drawn code of conduct developed by a coalition of investor groups to rate corporations on their environmental behavior.

"Industry is always going to have certain basic objectives: lands access, free market, etc.

"Our challenge will be how to more clearly define those objectives and then aggressively promote them to the public," Yosie said.

An example would be more of the joint research programs such as the one the oil industry is pursuing with the automobile industry on developing fuels and compatible engines to improve air quality.

"Joint programs like that are going to give us a bigger bang for the buck and have more credibility with the public as well."

In addition, Yosie expects API will spend more time talking with environmental groups and serving more to transfer information for companies on new regulations.

API's new stance is reflected in its spending. Yosie, whose department already receives 24% of the entire API budget, will see his research budget increased 8% this year, while most other budgets at the association are being held constant.

Profits affected

If nothing else, environmental concerns are going to have a direct effect on a company's bottom line.

"Not long from now, environmental compliance will be the single biggest cost center in E&P," said H.B. Scoggins Jr., president, Independent Petroleum Association of America.

New and upcoming major federal legislation and regulations affecting the refining industry calls for a cost of compliance of $18.8-22.2 billion year, Crown Central Petroleum Corp. Henry Rosenberg testified on behalf of U.S. independent refiners at Department of Energy hearings on developing a national energy strategy in Washington, D.C.

That excludes the billions of dollars currently spent each year on complying with existing environmental regulations or new state and local regulations, Rosenberg testified.

How gasoline pool composition will change

1988 average pool*	Volume percent	Octane range†
Blending butanes	7.0	91-93
Light straightrun	3.3	55-75
Isomerate	5.0	80-88
Cat cracked	33.5	84-89
Hydrocracked	2.0	85-87
Coker	0.6	60-70
Alkylate	11.2	90-94
Reformate	34.0	86-96
MTBE	1.4	106-110
Total	**100.0**	
Average octane†		**88.4**

1995 average pool*	Volume percent	Octane range†
Blending butanes	5.5	91-93
Isomerate	10.0	82-88
Cat cracked	34.5	85-90
Hydrocracked	1.5	85-87
Alkylate	12.5	90-94
Reformate	33.5	90-96
Ethers	2.5	106-110
Total	**100.0**	
Average octane†		**89.9**

* Does not include downstream blending.
† (R + M) 2 octane range.

reducing summer gasoline vapor pressure by 1 psi Rvp in the U.S., required less normal butane, and other low-boiling-point constituents in gasoline blends. Other processing sources had to be called upon to make up for the volume and octane lost by reduction of these compounds. Catalytic cracking and alkylation are important sources of lower-volatility, high-octane blend components.

Modern alkylation units include improvements that boost capacity of the units and increase quality of the alkylate product. New fractionator designs, for instance, include higher capacity trays that increase alkylate production.

New sulfuric acid unit designs include additional condenser heat exchange area to increase refrigeration capacity. This reduces reactor temperature which improves alkylate quality. The 1990s will probably see increased use of isomerization of C4 streams, although capacity of this process remained flat or declined slightly during the 1980s. Butane removed from gasoline to achieve vapor pressure limits will likely have lower value, making investment in butane processing units more attractive.

Oxygenates required

Rules were passed in several areas of the U.S. that require a minimum oxygen content in gasoline during winter months. Gasoline blends containing oxygen compounds reduce the amount of carbon monoxide (CO) emitted when the oxygenated gasolines are burned.

Although the requirement can be met by adding alcohols, such as ethanol and methanol, to the gasoline, the requirement is being met primarily by adding methyl tertiary butyl ether (MTBE). MTBE is made by reacting methanol with isobutene. MTBE is a favorable blending component because of its low blending Rvp, and properties that make it completely fungible in the gasoline distribution system. And increased isobutylene production from the use of octane boosting catalysts in the FCCU make it attractive for refiners to install MTBE capacity in their refineries.

Most gasolines in the 1990s will probably contain some amount of ethers to maintain required octane levels, and to reduce the amount of CO emissions (see table). Ethers are low vapor pressure blend components, so they can help meet stringent limits on gasoline volatility.

The push to utilize more ethanol in gasoline blends will likely be met by the use of ethyl tertiary butyl ether (ETBE). The process used to make ETBE is similar to MTBE, and ethanol is used instead of methanol. ETBE is as attractive as MTBE, with respect to blending and distribution properties. But to make ETBE competitive with MTBE, the current tax credit on ethanol blended directly into gasoline will have to be extended to the use of ethanol in ETBE.

Gasoline blending technology

New gasoline formulations require accurate blending of many refinery product streams to meet market requirements for high quality gasolines. Increased demand for higher octane and lower vapor pressure gasoline, the need to offer multiple gasoline grades, the need to blend addtives into the gasoline grades, and tough competition require that refiners increase their blending options and maintain tighter quality control to maintain production flexibility at minimum cost.

Modern gasoline blending facilities consist of advanced, on-line blend optimization systems in an integrated system that combines hardware and software with linear programming techniques.

Modern blending systems are capable of minimizing quality giveaway and reblends, while producing the most valuable gasoline at lowest cost by minimizing the use of high-value, high-cost components such as reformate, or purchased components, such as oxygenates.

Systems provide accurate qualtity control through the use of on-line analyzers, they reduce inventory of feed and finished products, and they increase the flexibility of the blending operation while maintaining accurate supply schedules. An example of a modern blending system is installed at Veba Oel GmbH at its Gelsenkirken, West Germany refinery (see diagram) Hardware for the system includes flow meters and control valves on tanks and transfer lines, a blend header with a special in-line mixer design, and a fast sample loop with on-line analyzers. A process computer serves as a central supervising unit that collects all data and calculates the optimum recipe, and downloads it to a ratio controller that controls the quantities of each gasoline component in the finished blend.

Distillate quality

Tougher emission rules will also apply to diesel and distillate fuels such as jet fuel. Proposed regulations on diesel fuel used in highway vehicles will limit sulfur content to 0.5 wt % and aromatics content to 10 vol %. The aromatics limit may be specified as a minimum cetane number. These limits will require more hydrotreating capacity, and require improved technology for aromatics saturation. Both process design and catalyst technology will be utilized to achieve the proposed diesel quality.

New military jet fuel compositions will reduce or eliminate naphtha components. To meet jet fuel demand, refiners will have to hydrocrack cycle oil and vacuum gas oil.

Heavy oil processes

Although during the late 1980s, the differential cost between light and heavy crude oils was low, heavy oil conversion processes continued to be developed and improved. And because the quality of crude and feedstocks is gradually declining, deep conversion processes will gain in importance in the decades to come. Traditional carbon rejection processes, such as delayed coking and visbreaking, are still important processes for upgrading heavy, residual feedstocks. But as product specifications become tougher to attain, better heavy-feed conversion will be required. As a

lated gasoline, a new blend intended to replace leaded regular along the Rocky Mountain front range.

The company's RG-87 is an unleaded blend that features lower volatility and cuts in aromatics levels. It uses methyl tertiary butyl ether to achieve an octane rating of 87 vs. 86.5 octane for the company's leaded regular. The blend's Reid vapor pressure is 1 psi below the state's motor fuel statute.

Amoco Oil Co. will sell a reduced volatility gasoline in July and August 1990 in parts of Illinois and Indiana and plans projects at its U.S. refineries to sell a reduced volatility product in its other marketing areas.

Sun Co. Inc. planned to develop several gasolines with reduced amounts of aromatics and olefins and increased amounts of oxygenates. Vaporization characteristics were to be altered to reduce the volume of fuel unburned during combustion and the amount that evaporates from the fuel tank and carburetor.

Sun expected emission reductions of about 15% for reactive organic compounds, a major cause of ozone formation, and at least 10% of carbon monoxide.

EPA proposed a rule that would reduce benzene emissions during gasoline handling operations by 68% and cost industry more than $1 billion.

The agency issued a final rule to reduce benzene emissions from industrial sources by 20,000 tons year and proposed rules to reduce other major benzene emissions another 14,300 tons year. Together the actions would reduce benzene emissions 90% from mid-1989 levels.

Star Enterprise, the Saudi Arabia-Texaco refining marketing joint venture, was studying feasibility of installing a resid upgrading unit at its 250,000 b d Port Arthur, Tex., refinery.

It said the unit would enable the refinery to boost the yield of gasoline, diesel fuel, and other light products from heavier crude grades that Star expected to proliferate in the 1990s and beyond.

If it found the project economic, construction would begin in second half 1990 and be complete in late 1992.

Star was installing a new alkylation unit at the plant, to be completed in 1990, and modernizing the lube oil extraction unit.

Restructuring and restarts continued in the refining industry. Marathon Petroleum Co. acquired Rock Island Refining Corp., including a 50,000 b d refinery at Indianapolis, Ind., that brought Marathon's refining capacity to 638,000 b d. The deal also included about 280 company gasoline stations and a 50% interest in 38 independently operated retail outlets.

Discovery Oil Ltd., Los Angeles, purchased and restarted the 15,000 b d CAS Oil Refinery at Lafayette, La. The plant produces naphtha, jet fuel, diesel, and fuel oil.

U.S. Refining & Marketing Co. Inc. planned to restart the 20,000 b d Cushing, Okla., refinery, idle and in receivership since 1982, by May 1990. The plant was to produce unleaded gasoline and diesel fuel, propane, resid, and other products.

Castle Energy Corp., Blue Bell, Pa., acquired and planned to restore a 55,000 b d refinery at Lawrenceville, Ill.

Crown Central Petroleum Corp. purchased the 50,000 b d Tyler, Tex., refinery and related facilities from Texas Eastern Corp.'s La Gloria Oil & Gas Co.

Three B Oil Co., Wickett, Tex., acquired from Adobe Resources Corp. and planned to upgrade a refinery at Wickett. The Rattlesnake refinery was to process 8,000 b d of oil from North Ward Estes and South Ward Estes fields and from a 5 mile line to be laid to All-American pipeline. It was to run an asphalt unit moved to Wickett from El Dorado, Ark.

Sunbelt Refinery Co., Randolph, Ariz., started up its 10,000 refinery with crude from All-American. The refinery, owned by Huntway Refining Co., Valencia, Calif., produces kerosine jet fuel, diesel fuel, and asphalt.

Tariffs on the U.S.-Canada energy trade

	U.S. tariff ¢(U.S.) bbl	Canadian tariff %
Crude oil		
Less than 25° gravity	5.25	none
25° gravity or higher	10.5	none
Distillate and residual fuel oil		
Less than 25° gravity	5.25	none
25° gravity or higher	10.5	none
Motor fuel, jet fuel	52.5	none
Kerosine, naphthas	10.5	none
Lubricating oil and greases	10.5	12.5
Petroleum gases—gaseous		
Natural gas	none	none
Propane	none	none
Butane	none	none
Petroleum gases—liquefied		
Natural gas	none	12.5
Propane	none	12.5
Butane	none	12.5
Petroleum coke	none	none
Petroleum bitumen	none	6.8
Asphalt and other residuals	none	none
Bituminous or oil shale, tar sands	none	10.2
Coal and solid fuels from coal		
Anthracite	none	none
Bituminous	none	none
Lignite	none	none
Coal gas, water gas	none	10.2
Electrical energy	none	none

Source: Canadian Energy Trends Quarterly

American International Petroleum Corp. reactivated a 30,000 b d Lake Charles, La., refinery in early 1989.

The wave of joint ventures and acquisitions in the U.S. refining industry that had a strong year in 1988 was less evident in 1989.

Petroleos de Venezuela SA completed a joint venture with Unocal Corp. regarding Unocal's Lemont, Ill., refinery, and purchased the 50% of Citgo Petroleum Corp. it didn't own from Southland Corp.

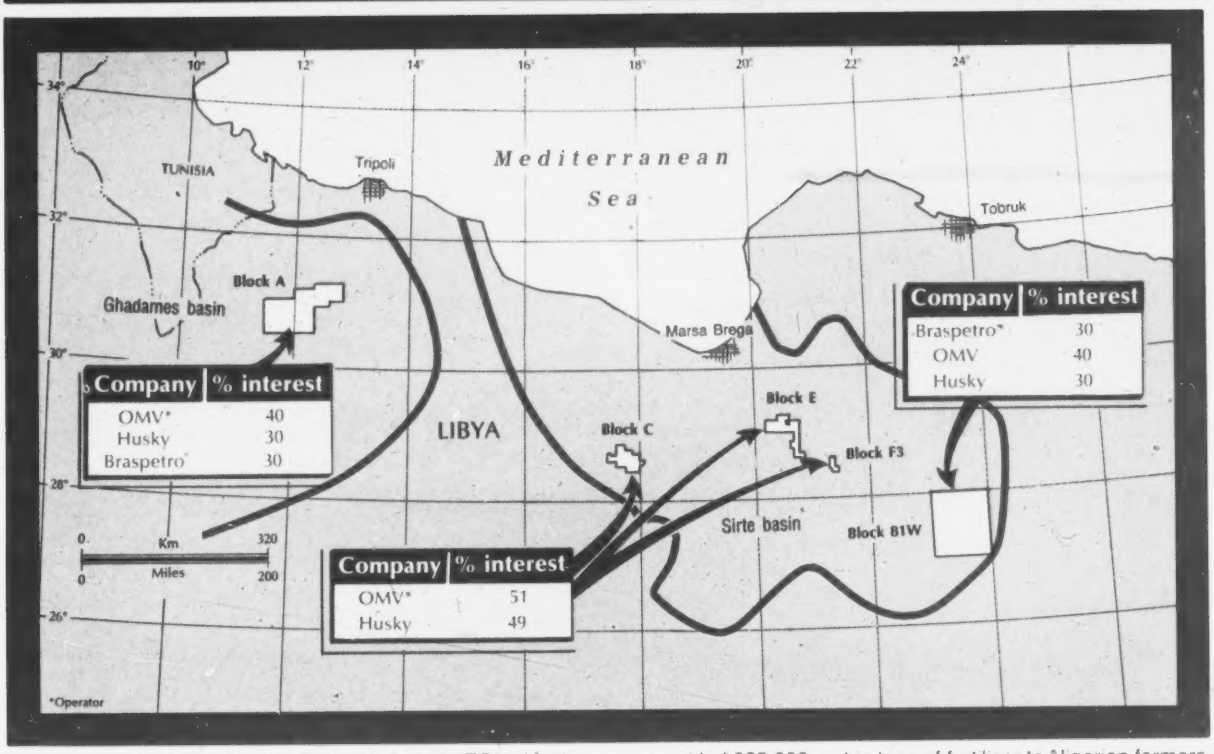
The upshot of all the deals is that non-U.S. entities owned interests in a gross 3.468 million b d or 22.5% of the nation's distillation capacity of 15,418,738 b d on Jan. 1, 1989.

The 3.468 million b d figure for non-U.S. ownership includes holdings, either direct or indirect, by Royal Dutch Shell Group, British Petroleum plc, Total Cie. Francaise des Petroles, Pdvsa, Saudi Refining Inc., Petrofina SA, Ultramar plc, Broken Hill Pty. Co. Ltd., and China National Chemicals Import & Export Corp. (Sinochem).

Members of the Organization of Petroleum Exporting Countries own interests in a gross 1.261 million b d or 8.2% of U.S refining capacity.

An Oct. 17 earthquake that rocked the greater San Francisco-San Jose area caused little damage to refineries or demand in the area.

Where the new blocks are in Libya



agreement with Exploration Consultants Ltd. (ECL), Henley, England.

Data packages on the frontier region were to be available early in 1990 in preparation for an exploration licensing round near the end of 1990 when Namibia, formerly Southwest Africa, is to be fully independent.

Earlier in 1989 ECL signed a contract with Swakor (Pty.) Ltd. to conduct major seismic, gravity, and magnetic surveys. ECL acquired 820 line km of data on the Kudu structure in the Atlantic Ocean off southern Namibia. HGS will use the Patrick Haggerty seismic survey vessel to shoot another 9,180 km of seismic and process all the seismic data, including the initial survey.

The survey program is designed to provide regional coverage of the entire area off Namibia. It will concentrate on zones believed to be of maximum industry interest, especially near the Kudu gas discovery drilled in 1974 by a unit of Chevron Corp.

NIGERIA

CAPITAL: Lagos
MONETARY UNIT: Naira
REFINING CAPACITY: 433,250 b/cd
PRODUCTION: 1,513 Mb/d
RESERVES: 16,000,000 Mbbl

NATIONAL FERTILIZER CO. OF NIGERIA LTD. (Nafcon) reported an on stream factor of 97.7% and an overall production rate of 112% in the first 2 years of operation of its 1,000 ton day ammonia fertilizer complex in Rivers State, Nigeria.

Nafcon Chairman Alhaji Hassan Adamu said the complex provided 225,000 metric tons of fertilizer to Nigerian farmers during the 1988 farming year.

Nafcon was to hand the Nigerian government a check for 12.5 million naira.

Adamu said it is unusual for a Nigerian company to begin loan paybacks after such a short time in operation.

The ammonia unit's design is based on proprietary M.W. Kellogg Co. technology.

The on stream factor for large ammonia plants of all design operating worldwide averaged 80.8%, as reported at the 1986 American Institute of Chemical Engineers ammonia symposium, the latest comparative figures available to Kellogg.

That factor includes downtime for any reason, including feed gas curtailment and inventory control. When those reasons are eliminated, the Nafcon unit's on stream factor has been 99.3%.

The 112% production rate "is the best record we have seen for any Kellogg ammonia plant's first 2 years of operation anywhere in the world," said J.R. LeBlanc of Houston, Kellogg manager of inorganic chemicals technology.

The Nafcon complex includes a 1,500 metric ton day urea plant and a nitrogen-phosphorous-potash mixed fertilizer unit.

The multinational group responsible for the complex included Kellogg and Kawasaki Heavy Industries Ltd., Marubeni Corp., and Nissho Iwai of Japan, and Jacobs Engineering Group of the U.S.

Kellogg is a minority partner in Nafcon, and the company has continuing involvement at the complex through its plant services group, which oversees maintenance and operations.

Nigerian demand for fertilizers is growing rapidly.

Adamu said Nigeria expects to require 180,000 metric

the same area, to be added when an aeromagnetic survey in the first exploration term is complete and a seismic survey has begun.

In the first 2 year exploration period, Mobil will spend $29.2 million to run 13,000 km of aeromagnetic survey and 1,600 km of gravimetric survey; conduct geological, geophysical, and geochemical studies to select drill sites; and drill one wildcat.

In the second period it will spend $36 million to shoot 1,300 line km of seismic survey, conduct further geological and geophysical studies, and drill two wildcats.

Mobil will spend $31.4 million in the third period to shoot 700 line km of seismic survey and drill two wildcats. The optional extension provides for spending of $10.9 million and drilling of another wildcat.

Wildcat depths must be 5,000 m or sufficient to evaluate Cretaceous, Jurassic, Triassic, and Paleozoic rocks.

The contractor must shoot at least 300 line km of seismic survey in each area if justified by the aeromagnetic survey.

For each successful wildcat, Mobil must drill another wildcat on a separate structure.

This drilling can be conducted during the first 2 years of development.

Mobil can withdraw with 30 days' notice if it has completed the minimum work required in the current period.

The contract term is 30 years if Mobil finds oil, 40 years if it finds gas.

It would receive a percentage of production, indexed to its accumulated income and expenses. Mobil would be allowed to export its share of production after local demand is met.

Within 180 days of the start of development, Mobil would have to complete two step-outs.

It would have to present a development and transportation plan to Petroperu and the government hydrocarbons office within 270 days.

Mobil would be responsible for construction of pipeline links to the North Peruvian Pipeline.

Petroperu has the option to participate in construction and operation and in as much as 50% of development.

Mobil will be subject to standard income tax. Oil prices and taxes will be calculated in dollars at the free market bank exchange rate.

The Central Reserve Bank will guarantee Mobil immediate access to foreign currency during the production stage.

Chambira development

Cash strapped Petroperu was pressing development of its Chambira oil and gas discovery in northern Peru.

It was drilling a second well directionally from the location of the discovery, Chambira 123X on Block 8.

The discovery flowed 2,900 b/d of 26° gravity oil.

The second well, Chambira 124XCD was targeted to 12,695 ft and was to take about 2 months to drill.

Petroperu wanted to drill 15 wells on the structure, which underlies an area 2.8 miles long and 2 miles wide.

Petroperu estimated reserves at as much as 30 million bbl. Petroperu engineers were planning the route for an 18 mile oil pipeline to Corrientes at the beginning of the North Peruvian pipeline.

They plan to use 6 in. pipe held in reserve for the existing line as well as casing pipe. Petroperu expects to pay the $7 million estimated cost of the first well, storage tanks, and a camp. But it must raise at least $70 million more.

Financing may be difficult in the wake of Peru's breaking from the international monetary system. The government dropped an earlier plan to invite private investors to develop Chambira.

Acreage released

Citing financial problems, Petroperu released some of its acreage to the state.

It is offering contracts for other areas.

It especially hoped to let contracts for Blocks 35 and 50, where it has shot seismic surveys and considers potential high.

It was negotiating contracts with Mobil Oil Corp. for Blocks 28-30 and 53 in the Huallaga basin and with Peruvian companies V&G Exploraciones SA and Geopet SA for Block S-2 in the Titicaca basin.

Petroperu retained the Talara producing area on the northern coast, where Oxy and Argentina's Bridas SA produce about 6,000 b/d under a secondary recovery contract.

The blocks Oxy seeks north of Block 36 are Blocks 32 and 34.

Oxy was focusing on a structure called Shahuinto in the northeast corner of Block 36 for its possible third wildcat on the tract. It was evaluating data from the other tests, La Colpa and Platanal, and was to make a decision on where to drill its next wildcat.

Victor Lai, Oxy exploration manager in Peru, told the National Geological Society exploration of the Shahuinto structure will target Cretaceous formations.

Oxy earlier planned to drill at Tahuania, south of La Colpa, and had begun road construction to a drillsite but changed plans after failing to find commercial oil in the first two wells.

At La Colpa it drilled to 9,600 ft and reported Peru's first Paleozoic oil shows in the Copacabana and Tarma formations.

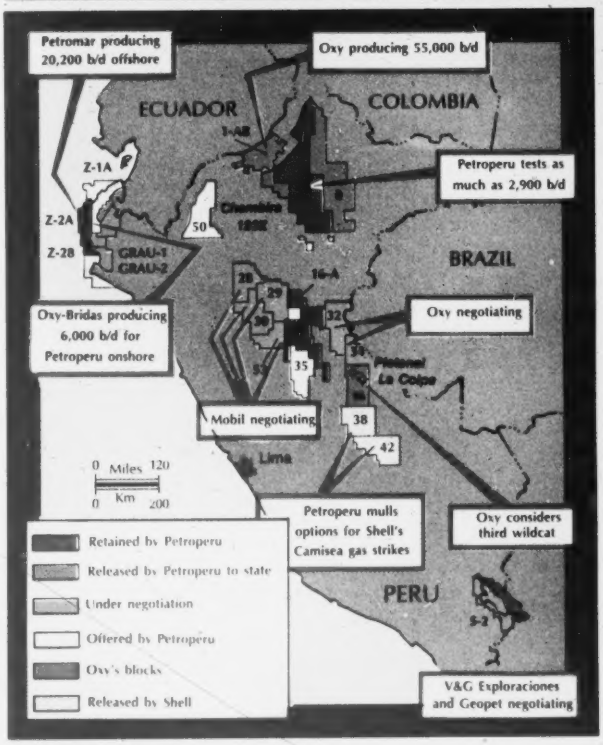
The rocks lacked permeability.

Oxy also found oil in Cretaceous Agua Caliente sandstone but couldn't case the formation.

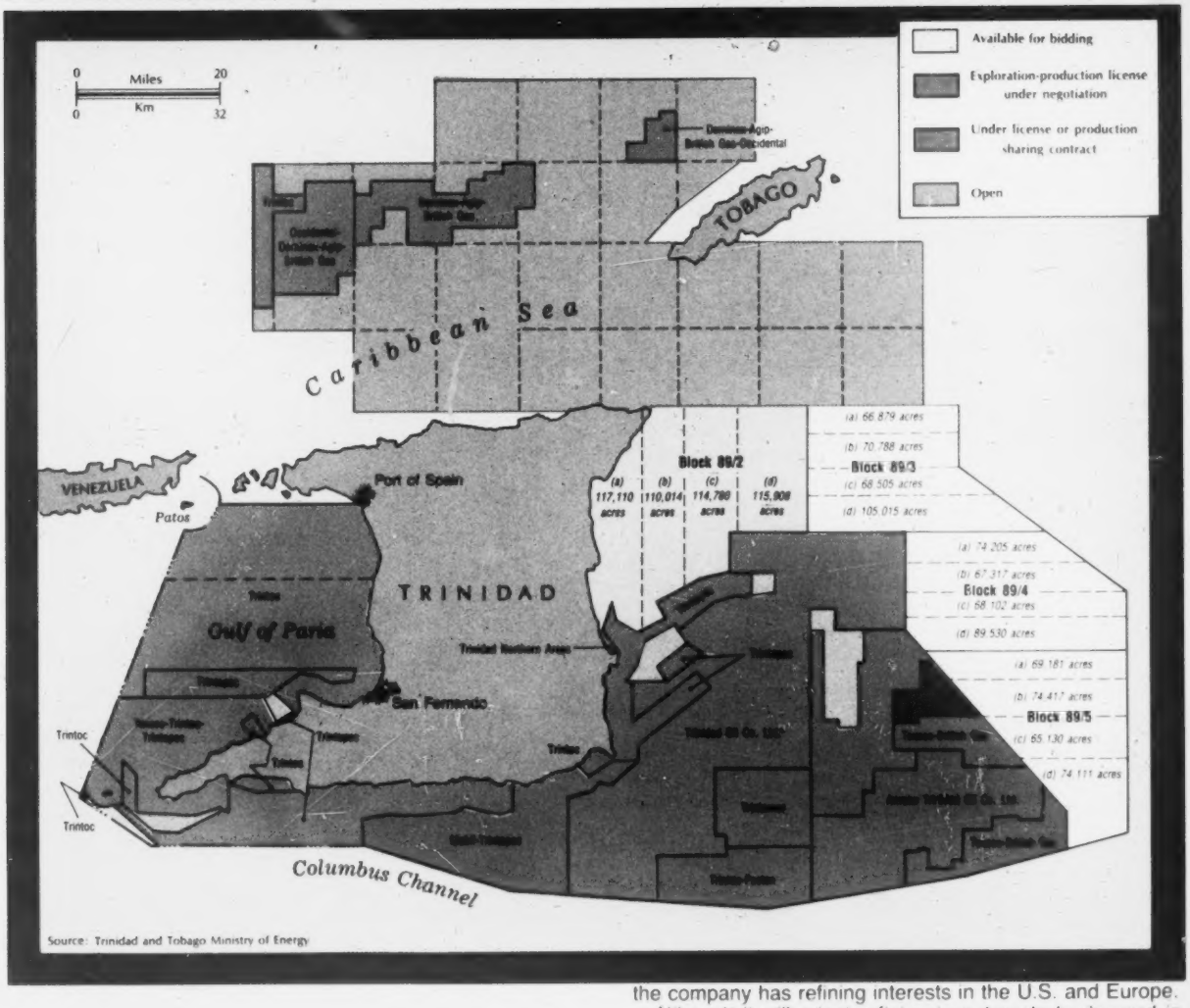
On the smaller Platanal structure Oxy also had oil shows in rocks with low permeability.

It drilled the test to 11,300 ft.

Where the petroleum action is in Peru



Where acreage is up for bids off Trinidad



VENEZUELA

CAPITAL: Caracas
MONETARY UNIT: Bolivares
REFINING CAPACITY: 1,201,100 b/cd
PRODUCTION: 1,731.6 Mb/d
RESERVES: 58,504,000 Mbbl

VENEZUELA PLANS TO RAISE REFINING CAPACITY by 360,000 b d during the next several years.

Half the increase is to come from capacity additions at five refineries.

The other 180,000 b d will be the capacity of a new refinery at an undetermined location near one of the existing plants.

Venezuela has six refineries: Amuay and Punta Cardon in Falcon, El Toreno in Barinas, El Palito in Carabobo, and Puerto La Cruz and San Roque in Anzoategui. Capacities of these refineries total 1.2 million b d.

Pdvsa also leases a 300,000 b d refinery on Curacao, and the company has refining interests in the U.S. and Europe.

Although it will orient refining investments to demand in industrialized countries for high quality light products, the company doesn't expect to invest heavily in deep conversion capacity.

That's partly because of its light and medium crude discoveries in eastern Venezuela and partly because it doesn't think margin projections for the next several years justify deep conversion investments.

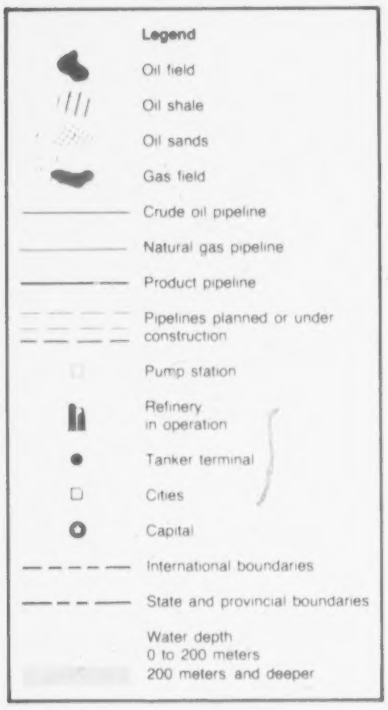
Pdvsa's refineries have conversion capacities totaling about 815,000 b d.

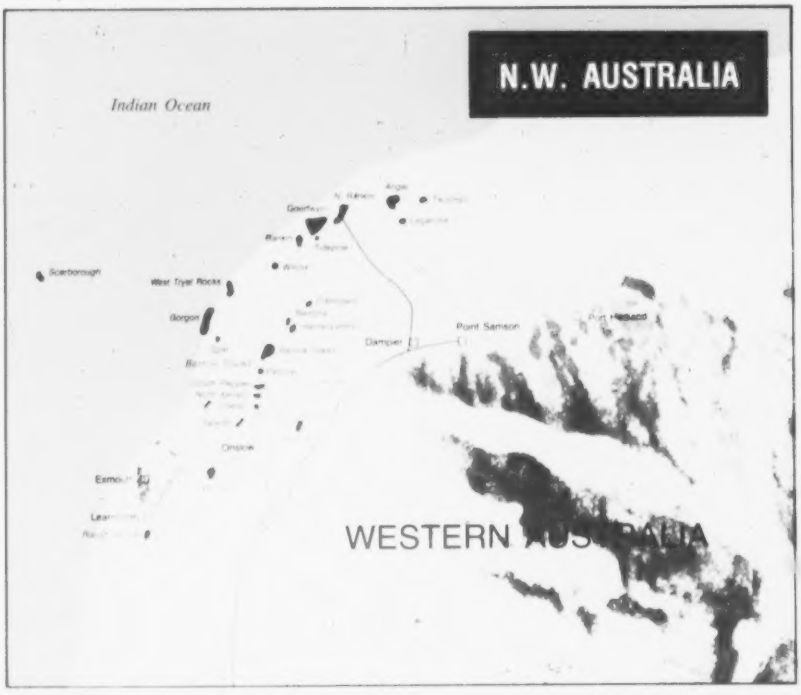
Corpoven SA of Venezuela will spend $600 million to expand design gas processing capacity by 50% at its Eastern Cryogenic Complex in Anzoategui and add ethane extraction.

The complex went on stream in 1985.

It involves a turboexpander extraction plant in San Joaquin gas field near Anaco and a fractionation plant with design capacity of 70,000 b d at Jose, on the Caribbean 60 miles north.

The complex processed an average 832 MMscfd of gas in 1989, producing 49,500 b d of gas liquids, 39% of which was exported.





Permits on offer

Australia placed on offer 12 exploration permits off three states in a licensing round which was open through Feb. 16, 1990.

Ten of the permits are in the Perth basin off Western Australia, one is in the Bass basin off Tasmania, and one is in the Carpentaria-Karumba basin off Queensland.

The offshore Perth basin, containing 880 offered blocks in its permits, is largely unexplored and not under license. Onshore, five fields are on production out of 14 discovered. The rest are either uneconomic or depleted.

Northern fields in the Perth basin produce mainly dry gas with little condensate. Those in the south yield a highly paraffinic crude often solid at the surface. Most of the offered tracts lie in less than 200 m of water.

The lack of offshore well data hinders evaluation of the extent of source rocks and reservoir quality.

Locally the Lesueur sandstone, Cockleshell Gully, and Yarragadee formations have the best of extremely variable porosity in the north. To the south, isolated sands within Lower Cretaceous have reasonable reservoir characteristics. Oil has been recovered from the Gage Roads member of the South Perth shale in 1 Gage Roads.

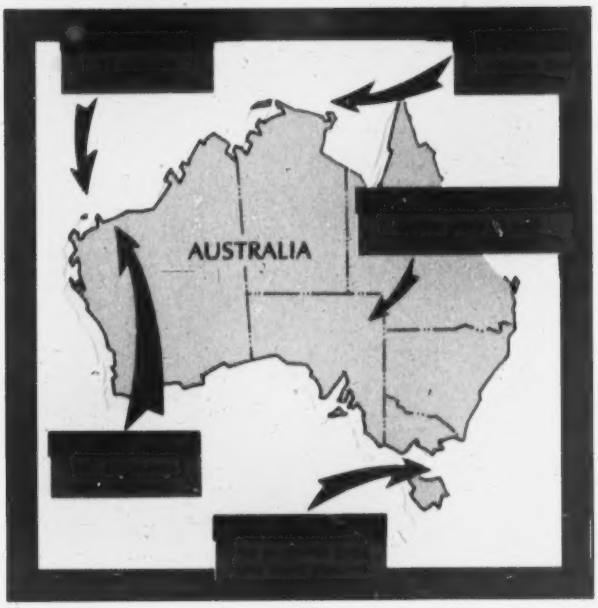
The depth of prospective targets ranges to about 3,300 ft for oil and 16,500 ft for gas. Oil shows have been found at less than 1,650 ft but are often biodegraded or the reservoirs are flushed. The Gulf of Carpentaria and Bass basin areas to be offered also are lightly drilled. Area Q89-1, made up of 349 blocks off Queensland, is one of the largest undrilled areas off Australia.

It occupies the east central part of the Mesozoic Carpentaria and Cainozoic Karumba basins. Water depths are about 200 ft. Maximum sediment thickness is about 5,741 ft, and interpretation of geology is speculative.

Area T89-5 off Tasmania, with 99 blocks, is in less than 90 ft of water.

Three companies or groups have explored the Bass basin previously. One well was drilled, the shallow 1 Tasmanian Devil, in 1984.

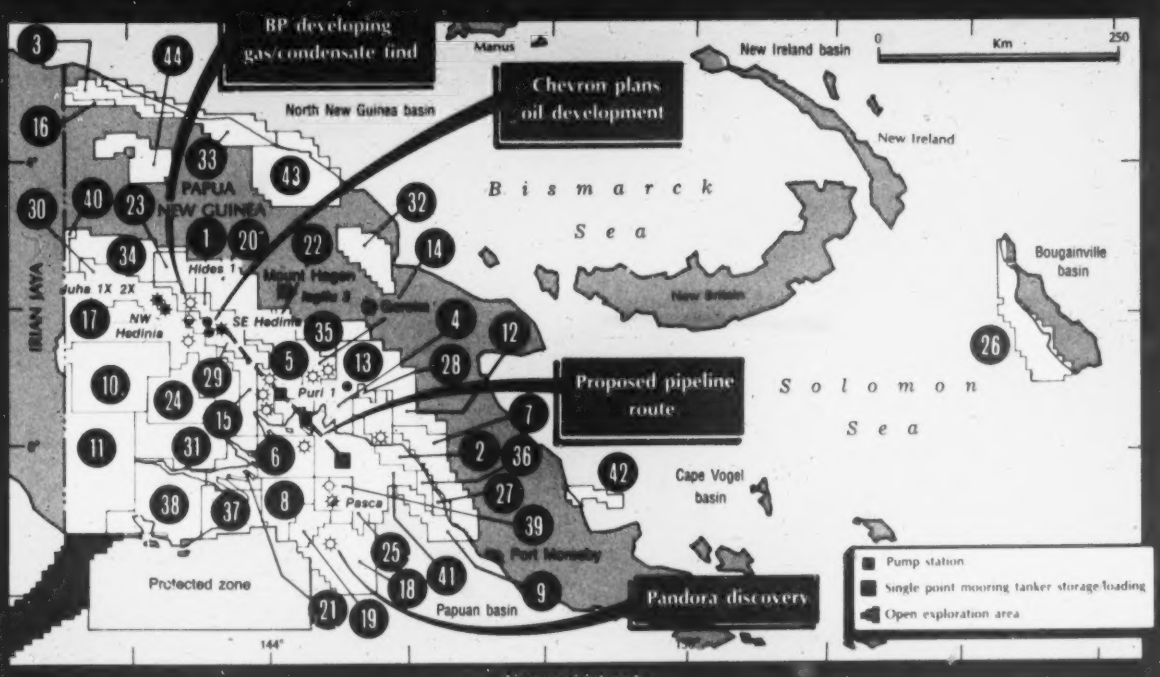
Where Australian action is heavy



Refining plans

Australian refiners plan to spend almost $2 billion (Australian) during the 1990s to expand and upgrade their operations. Factors fueling the planned investments include the end of the federal government's indigenous crude oil allocation system, growing demand for transportation fuels, and declining domestic crude oil production.

Where Papua New Guinea's first oil and gas development will be



Licensees' interests

Key	PPL no.	No. of blocks	Type*	Term	(Operator listed first) Per cent
1	27	47	E	11/14/86-11/14/91	BP 95, Oil Search 5
2	30	60	E	9/25/90-9/25/95	Petro-Canada 29.17, K. Graham 18.33, Austin Ltd 50, 2 [illegible]
3	31	31	E	9/25/90-9/25/95	Trade No. 86 5%, Ltd. 5%, K. Graham 90, Austin 10
4	32	60	E	6/29/89-6/29/89	Kutubu Exploration PL 100
5	34	31	E	12/12/85-12/12/95	Base 50%, Mountbatten West 2 [illegible]
6	39	36	E	2/4/85-2/4/95	CRW Inc. Yukong 20, Ema 20 [illegible]
7	40	84	E	1/14/89-1/14/92	S.E. Oil & Gas, Nougas Mining 45, Andrew Kugler 25, W.R. Newberry 10, Austin 5
8	45	64	E	1/14/89-1/14/95	Pioneer Oilfield 100
9	46	40	E	8/8/86-8/8/96	Trade No. 84 PL Kugler 90, Austin 10
10	48	161	E	1/14/89-1/14/95	Kutubu Exploration 40, ANZ Petroleum 4[illegible]
11	49	200	E	1/14/90-1/14/92	Kutubu 40, ANZ 10
12	52	64	E	10/27/86-10/27/96	Arrow Energy 100
13	54	127	E	11/1/86-11/1/96	Trade No. 86 PL Kugler 45, Newberry 45, Austin 10
14	58	16	E	11/23/90-11/23/95	Trace Petroleum 50, Base 50
15		40	A	12/1/90-12/1/92	Probably Gentoo 60, Cutter/PNG Ventures 40
16	68	16	E	11/24/89-11/24/92	Trade No. 86 PL Gentoo 45, Newberry 45, Kugler 10, Austin 10
17	81	200	L	1/1/81-1/1/91	Saltilo Ltd. 100
18	82	124	E	2/20/91-2/20/91	International Petroleum (Bermuda) 40, Sedco/Forex 40, Southside & Investment Co. Nowsco 10, Arthur Anthony 10
19	83	32	L	2/1/91-2/1/91	Pioneer 100
20	84	1	L	1/1/91-1/1/91	BP 100
21	85	60	E	7/1/85-7/1/95	Papuan Gulf Petroleum Ltd. 100
22	89	98	C	7/11/87-7/11/91	Lakes Oil (PNG) 50, Mamebar 50
23	91	46	C	7/11/87-7/1/91	Sage Exploration 100
24	94	96	L	11/13/87-11/13/91	Bovas Exploration 100
25	95	77	L	7/1/87-7/1/93	International Petroleum Corp. 100
26	96	95	A		International Petroleum Corp. 100
27	98	56	C	12/29/87-12/29/91	Papuan Gulf Petroleum Ltd. 100
28	99	56	L	12/29/87-12/29/91	Papuan Gulf Petroleum Ltd. 100
29	100	49	C	8/1/91-8/1/91	Chevron 25, BP 25, Petrol Pet. 24.983, BHP 12.5, Merlin Petroleum 8.25, Ltd. 100, Search 10.017, Merlin Papua 8.25
30	101	60	C	8/1/91-8/1/91	Chevron 25, BP 25.01, Ampol 12.99, Petrol 12.99, Merlin Petroleum 8.25, BHP [illegible] 12.5, Search 8.25
31	102	132	C	12/29/87-12/29/91	Gold Inc. 100
32	103	161	L	12/29/87-12/29/91	Papuan Gulf Petroleum Ltd. 100
33	105	84	L	3/25/88-3/25/94	Armadale One PL 100
34	106	83	C	2/1/88-2/1/94	Victoria Exploration PL 33.3, Highland Petroleum 33.3, PNG Pl. 33.3, First Australian Resources PL 33.3
35	108	60	C	2/10/88-2/10/94	IMOil, Resources Ltd. Nowsco 33 1/3, Hudbay 25, Pagoo 20
36	109	1	C	11/1/88-11/1/91	S.E. Oil & Gas, Nougas Mining 45, Kugler 25, Newberry 10, Austin 5
37	112	71	C	8/10/88-8/10/94	Petro Pacific 40, Batabata 30, Papex 30
38	113	161	L	8/10/88-8/10/94	Commonfuel Oil 50, Batabata 50
39	116	15	A		International Petroleum Corp. 100
40	117	9	PT		Victoria 33.3, Highland 33.3, First Australian 33.3
41	118	141	A		International Petroleum (Bermuda) 100
42	119	80	A		Condula Exploration 80, Allstate Int'l Resources 20
43	120	151	A		Anderman/Smith Operating Co. 100
44	121	60	A		Armadale One PL 100

*E = Extension; C = Current; A = Application; O = Offered.

IPE
ATLAS

CHINA

CHINA

CAPITAL: Beijing
MONETARY UNIT: Yuan renmindi
REFINING CAPACITY: 2,200,000 b/cd
PRODUCTION: 2,770 Mb/d
RESERVES: 24,000,000 Mbbl

CHINA IS TRYING TO OVERCOME CONSIDERABLE OBstacles to boost oil and coal production in the 1990s.

An ambitious energy plan for the 1990s completed by China's Ministry of Energy Resources continues an accent on coal, the country's most plentiful fuel.

However, a shortage of railroad capacity in many areas poses a major obstacle for distribution of coal, oil, and products.

China plans to construct several coal slurry pipelines to ease the burden on railroads.

Coal transport occupies more than 40% of the capacity of China's railroads.

China produced 2.85 million b/d of oil in September 1989, up only 1.6% from September 1988, China Daily reports.

The largest oil production growth areas are expected to be the Bohai Sea and the Tarim and Junggar basins of Northwest China.

The Bohai Sea is relatively near consuming areas, but oil transport from the Northwest is seen as practically insurmountable.

Domestic demand for China's oil is surging, and one of the country's leading economic research firms has recommended that China reduce its oil exports drastically in the 1990s even if domestic production rises as planned.

Use of more domestic crude for petrochemical production would more than offset lower hard currency earnings resulting from smaller oil exports, said China International Engineering Consulting Corp. (Ciecc).

Ciecc also favors sharply higher oil imports to meet China's needs as long as international crude prices remain low and petrochemical prices—especially for ethylene—are strong.

1990s energy plan

China has invested too little in the energy industry during the past four decades, the energy ministry's plan says.

The new plan calls for reducing industrial and agricultural power consumption by 42%.

It looks toward generating capacity of 240 million kw year of electricity and providing electricity to 29 counties that still depend on kerosine for lighting, China Daily reported.

The plan calls for delineating 100 billion tons of coal reserves, 12.5 billion tons of crude oil, 1.5 trillion cu m of gas, and at least 70,000 tons of uranium.

It also calls for completion of preliminary designs for large and medium sized hydropower stations with a combined installed capacity of 60 million kw.

The second and third phases of expansion of the Qinshan nuclear station are expected to be finished by the end of the century, making it China's major nuclear power center. Developed coastal regions may also start their own small

How China's performance compares with its plan

	Jan.-Aug. 1989 results	1989 plan	% of 1989 plan	Comparison with Jan.-Aug. 1988 (1988 = 100)
PRODUCTION				
Oil (million tons)	90.63	139.00	65.20	100.67
Gas (billion cu m)	9.70	14.00	69.25	103.82
Condensate (million tons)	56.53	0.70	80.76	118.55
NEW PRODUCTIVE CAPACITY				
Oil (million tons)	5.368	17.79	30.17	96.29
Gas (billion cu m)	0.255	0.70	36.43	108.97
FIELD OPERATIONS				
Hole drilled (million m)	10.86	14.54	74.68	104.79
2D seismic (1,000 line km)	68.9	101.00	68.22	73.83
SPENDING (billion yuan*)	12.943	23.42	55.26	136.2

*Exchange rate as of Nov. 16: 1 yuan = 26.87¢ U.S.

Source: China Features from China National Petroleum Corp. data

1995 yet represent less than 3% of total output.

That's a smaller offshore contribution than the Chinese government expected when it began opening its continental shelf to foreign exploration in 1979. But unforeseen onshore production gains have more than offset the shortfall. Therefore, says Wu Kang of the East-West Center's China Energy Study, Chinese production might climb to 3.3 million b d in 1995 from as much as 2.75 million b d in 1988, with offshore flow reaching perhaps 100,000 b d.

For Chinese offshore exploration and production, that means growth—but not the surge some companies thought possible a few years ago.

"The old dream of striking it rich off China is over, and the rush of foreign investment may never come again," Wu says.

"Instead, it is time for China National Offshore Oil Corp. (Cnooc) and foreign oil companies to develop a feasible investment strategy based on long term considerations."

Wu bases his production forecast partly on strong performances of China's main onshore fields and on development plans and studies offshore.

Enhanced recovery has maintained production at the 1976 level of 1 million b d in Daqing field, China's biggest. Fear that Daqing and other old fields had peaked led to the government's offshore exploration focus in the late 1970s.

New technology and imported equipment have improved operations and sustained production growth in geologically complex Shengli oil field, which is expected to eclipse Daqing in importance during the 1990s.

And production in Liaohe oil field, the third largest onshore field, continues to grow, rising to 256,000 b d in 1988 from 230,000 b d in 1987.

In contrast to the flourishing onshore, Wu says, China's offshore is "semidepressed." Only two offshore oil fields were on stream.

Chengbei, discovered in 1972 by Bohai Oil Co., produced 8,000 b d in 1988 vs. 3,360 b d in 1986.

Japan China Oil Development Corp. (Jcodc) was developing the field with Bohai Oil under an agreement signed in 1980.

The other offshore field, Weizhou 10-3 in the Beibu Gulf basin, produced 7,030 b d in 1987. In 1988, Cnooc's Nanhai West Oil Corp. replaced Total Chine as operator.

Development was under way or planned in seven offshore fields. They are:

• Bozhong 28-1 oil field. Jcodc and Bohai Oil installed a single point mooring and were building a floating production storage and offloading system with capacity of 13,000 b d. The BZ28-1-1 discovery well flowed 7,000 b d in May 1981. Production was to begin, peaking at 8,600 b d in the 1990s. Reserves are estimated at 30 million bbl.

• Bozhong 34-2 4E oil field. Scheduled to go on stream in October 1989, Bozhong 34-2 4E has unconfirmed reserves of 35 million bbl. Production will peak at about 9,600 b d. Jcodc and Bohai Oil are developing the field with a wellhead jacket on each of two structures—BZ34-2, discovered in 1982, and BZ34-4E, discovered in 1984. They also were installing an SPM, a floating storage unit, two 1.2 mile marine flow lines, and a water injection platform.

• Suizhong 36-1 oil field. Cnooc was handling development and financing of Suizhong 36-1, a 1986 discovery with reserves of 900 million bbl. It let a $645,000 contract to Gustavson Associates Inc., Boulder, Colo., for a geologic and reservoir study.

Production was planned to start in 1990, peaking at 24,000 b d of 12-16° gravity oil.

• Weizhou 11-4 oil field. Nanhai West completed reservoir evaluation and development studies in 1987 and was conducting conceptual design work.

Weizhou 11-4 was to start flowing in 1990. Production will peak at about 1,000 b d.

• Huizhou 21-1 oil field. ACT Operators Group—Agip Overseas Ltd., Chevron Orient Inc., and Texaco Orient Petroleum Co.—will develop Huizhou 21-1 with Nanhai East Oil Corp. under a production sharing contract with Cnooc. The HZ21-1-1 discovery flowed 13,000 b d of crude in 1985. Basic design was under way for a development plan by the former Ministry of Petroleum Industry. Construction was to be complete by second quarter 1990, with production beginning in mid-1990 and peaking at 19,600 b d. Unconfirmed reserves are estimated at 30 million bbl.

Spending and production off China

FOREIGN SPENDING FOR EXPLORATION

1979-83	1984	1985	1986	1987	1988	Total
			Million U.S. $			
770	530	500	280	260	200	2,540

CRUDE OIL PRODUCTION

1988	1989	1990	1995
		1,000 b/d	
14-15	18-22	26-28	80-100

PERCENT OF TOTAL OIL PRODUCTION

0.5	0.7	0.9	2.8

Source: East-West Center

• Xijiang 24-3 oil field. A combine of Phillips Petroleum International Corp. Asia and Pecten Orient Co. will develop Xijiang 24-3 in conjunction with Nanhai East under a production sharing contract with Cnooc. The XJ24-3-1 discovery well flowed 6,840 b d in 1985, followed by the XJ24-3-2 at 14,755 b d. The field, with unconfirmed reserves of 45 million b d, is expected to start production in 1992. Flow will peak at 3,200 b d.

• Jinzhou 20-2 gas condensate field. Cnooc, using Bohai Oil facilities and World Bank assistance, was developing Jinzhou 20-2 with two production platforms. The field was to begin flow in 1990, producing 17.7 bcf year of gas and 50,000-120,000 metric tons year of condensate. Reserves are estimated at 706 bcf of gas, 22 million bbl of condensate, and 533 million bbl of oil.

Wu cites four fields under feasibility study for development and four other fields where plans are less definite.

Amoco Orient Petroleum Co., working with Nanhai East, was studying Liuhua 11-1 oil field.

The LH11-1-1A wildcat flowed 2,240 b d of 21° gravity oil from reef limestone on the western end of the structure in March 1987.

LH11-1-2, on the structure's east end 10 miles away, flowed 1,400 b d the next month.

The field might go on stream in the 1990s with production peaking at 19,600 b d.

Japex Huanan Oil Operating Group was studying development of Lufeng 13-1 oil field with Nanhai East.

The LF13-1-1 wildcat flowed 6,700 b d of 31° gravity oil in January 1987.

Production could start in the 1990s and peak at 19,600 b d. Weizhou 6-1 gas, condensate, and oil field, discovered by Nanhai West in 1987, was under study by Cnooc. The discovery well found as much as 400 ft of pay and flowed 330 MMcfd of gas, 1,275 b d of condensate, and 1,090 b d of crude oil.

Development of Yacheng 13-1 gas field was delayed in 1987 by disagreements between operator ARCO China Inc. and Cnooc.

In September 1988, the companies signed an agreement under which Cnooc took 51% of the joint venture, leaving ARCO 34% and Santa Fe Mineral (Asia) Inc. 15%.

Nissho Iwai Corp. might join the venture. The field, possibly starting production by 1993, would supply feedstock and power for new ventures on Hainan Island.

WORLDWIDE GAS PROCESSING

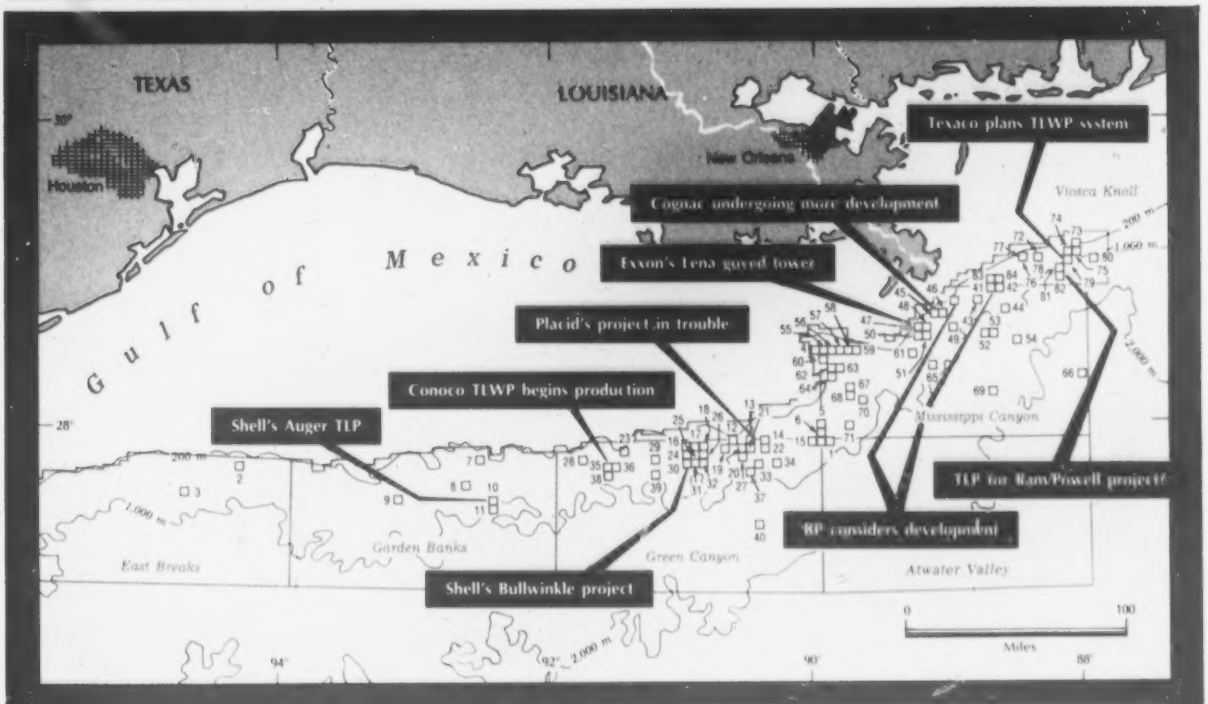
Capacities as of Jan. 1, 1989, and average production

Country	No. plants	Gas capacity	Gas throughput	Oil cond.	Plant liquids	Production, 1,000 gal/day, average based on the past 12 months: Propane or propane/butane	LP-gas mix	Raw NGL mix	Debut nat. gasol.	Other	Total products
United States											
Alabama	7	255.0	198.8		185.5		153.5	6.4		104.3	449.7
Alaska	3	3,333.5	3,326.2		3.5				2,140.1	16.6	2,160.2
Arkansas	4	933.0	580.6		3.0		4.0		74.4	6.0	3.0	90.4
California	34	999.7	690.2		479.8	48.6	273.4	79.8	170.3	284.5	11.5	1,347.9
Colorado	38	982.5	573.3		192.8		42.0	44.6	584.8	31.0	10.2	905.4
Florida	2	790.0	642.0	79.4	121.1	13.3	61.4			63.1		338.3
Kansas	24	5,562.5	3,587.1	226.6	840.8	117.8	448.9	0.9	749.3	363.8	1.6	2,749.7
Kentucky	2	71.0	67.5						169.3			169.3
Louisiana	77	18,921.1	11,069.9	1,285.6	1,116.8	346.6	461.2	35.6	5,719.8	674.4	322.6	9,962.6
Michigan	29	4,763.1	1,552.5		76.4			33.6	628.4	88.1	50.9	877.4
Mississippi	6	901.0	390.8		8.3		7.7		11.8	9.4	1.8	39.0
Montana	7	27.0	10.7		29.6	6.8	5.5	21.0	15.1	10.5	1.0	89.5
Nebraska	1	1.5	0.6						0.4			0.4
New Mexico	28	3,346.4	2,164.8	157.4	157.8	12.2	45.2		4,905.2	50.3	28.2	5,356.3
North Dakota	8	193.6	120.1		187.9		92.9	17.8	56.6	95.1	13.2	463.5
Oklahoma	101	4,613.5	2,846.6	740.0	775.7	109.5	283.1	798.4	4,181.9	316.6	234.8	7,440.0
Pennsylvania	2	14.0	7.9		4.1		3.3			3.9		11.3
Texas	311	16,786.0	10,918.3	3,715.1	3,938.7	564.0	1,635.9	447.6	15,301.4	1,603.8	1,994.4	29,200.9
Utah	12	522.5	281.5		76.5		24.2		160.4	45.8	115.4	422.3
West Virginia	7	397.0	320.2	231.9	137.9	22.6	43.3	88.2	255.8			779.7
Wyoming	39	3,333.0	2,497.3		268.5	12.9	193.1	56.4	2,377.6	735.6	1,673.9	5,318.0
Total U.S.	**742**	**66,746.9**	**41,846.9**	**6,436.0**	**8,604.7**	**1,254.3**	**3,778.6**	**1,630.3**	**37,502.6**	**4,486.2**	**4,479.1**	**68,171.8**
Abu Dhabi	5	1,602.0	1,269.0							546.0		546.0
Algeria	4	5,335.2	4,268.2					632.8			5,449.2	6,082.0
Argentina	13	1,344.8	1,322.1	694.9	406.8		267.0			425.3		1,794.0
Australia	5	2,573.0	1,376.0	279.0	441.0		249.0	610.3		1,058.5	850.0	3,487.8
Austria	1	17.5	13.7					26.7		28.4		55.1
Bahrain	1	168.0	155.0		115.0		100.0			152.0		367.0
Bangladesh	2	240.0	178.0								8.2	8.2
Bolivia	2	474.0	177.3		1.4	2.5		161.7		61.5	136.9	364.0
Brazil	10	437.8	414.7	6.1				618.9	239.4	142.5	49.4	1,056.3
Brunei	2	1,032.0	832.4		9.4				50.1	252.1		311.6
Canada												
Alberta	446	22,396.6	12,453.0	5,210.3	2,611.7	830.3	594.9	1,400.8	3,710.0	3,661.0	585.2	18,604.2
British Columbia	14	2,299.3	1,348.0		211.4	25.2	109.6			21.6	71.4	439.2
Northwest Territories	2	196.0	16.9									
Saskatchewan	24	295.1	194.2					12.9	104.7	0.3	18.0	135.9
Chile	2	470.0	423.0		190.0		120.0			106.0		416.0
China, Taiwan	4	271.0	123.8	38.5	27.6	1.5	17.5		8.7	14.3		108.1
Colombia	5	323.0	201.0	102.5	53.0		56.0	48.3		61.5		321.3
Denmark	1	450.0	240.0								100.0	100.0
Dominican Republic	1										277.2	277.2
Dubai	1	330.0	330.0								650.5	650.5
Ecuador	2	41.0	20.5					97.1		37.3		134.4
Egypt	8	1,320.0	1,188.0					664.4			1,288.6	1,953.0
France	1	570.0	563.0		139.0		132.0			270.0		541.0
Germany	4	385.0	324.0									
Greece	2	39.0	31.2						72.0			72.0
Hungary	12	1,078.1	683.6		50.7	5.8	51.8	124.8	332.6	172.8	415.3	1,153.8
Indonesia	10	2,797.5	2,665.0		426.5			51.6	1,455.7	205.7	366.4	2,505.9
Italy	17	7,614.0	1,587.0					2.7	8.0	7.5		18.2
Kuwait	1	1,815.0	1,452.0		1,722.0		980.0			811.8		3,513.8
Libya	7	1,851.0	1,227.0					47.8	5,577.0		551.0	6,165.8
Malaysia	2	282.0	105.0	161.4	23.2	136.3	28.2			154.1		503.2
Mexico	11	4,649.0	3,370.4	12,704.9							9.5	12,714.4
Netherlands	1	350.0	35.0								1.8	1.8
New Zealand	4	1,152.0	533.0		49.1		1.1	97.0		9.0	733.7	879.9
Norway	2	950.0	507.0		682.0	108.0	256.0		200.0	193.0		1,439.0
Oman	8	626.0	309.4						202.0	43.0		245.0
Pakistan	6	430.0	187.7					48.8	6.1		9.1	64.0
Peru	2	70.0	37.0		3.4		1.0	5.6	28.9		4.0	42.9
Qatar	2	579.0	232.0		434.6		255.5			173.0		863.1
Saudi Arabia	5	4,300.0							1,176.0			1,176.0
Sharjah	2	990.0	925.0		221.0		251.0				1,341.0	1,813.0
Spain	3	428.0	177.0								73.0	73.0
Thailand	2	850.0	550.0					400.4	8.4	84.0		492.8
United Kingdom	8	3,732.0	1,537.0		332.0		291.0		155.4	1,748.5	53.8	3,853.3
Venezuela	14	2,913.0	2,557.0	213.3	197.4		113.4	231.3	3,274.6	171.9		4,201.9
Yemen	1	400.0	137.7							86.0		86.0
Total, outside U.S.	**682**	**80,466.9**	**46,278.8**	**19,410.9**	**8,338.2**	**1,109.6**	**3,875.0**	**5,273.9**	**16,609.6**	**10,698.6**	**13,043.2**	**78,359.0**
World Total	**1,424**	**147,213.8**	**88,124.0**	**25,846.9**	**16,942.9**	**2,363.9**	**7,653.6**	**6,904.2**	**54,112.2**	**15,184.8**	**17,522.3**	**146,530.8**

Gas production (billions cu ft)

	1989
WESTERN HEMISPHERE	
Argentina	846.2
Barbados	0.7
Bolivia	100.9
Brazil	117.2
Canada	4,161.0
Chile	36.1
Columbia	170.1
Ecuador	3.6
Guatemala	0.3
Mexico	1,307.4
Peru	46.0
Trinidad	183.7
United States	17,917.0
Venezuela	740.1
Total	**25,630.3**
EUROPE	
Austria	40.8
Denmark	100.1
France	110.1
Germany, Fed. Rep	567.2
Greece	2.9
Italy	707.4
Netherlands	2,606.3
Norway	1,014.9
Spain	52.7
Turkey	3.0
United Kingdom	1,520.8
Total	**6,726.2**
MIDDLE EAST	
Bahrain	193.9
Iran	793.9
Iraq	201.8
Israel	1.3
Kuwait	222.9
Oman	80.4
Qatar	256.3
Saudi Arabia	1,079.8
Syria	24.5
United Arab Emirates	790.7
Total	**3,645.5**
ASIA-PACIFIC	
Afghanistan	104.7
Australia	629.7
Bangladesh	156.4
Brunei	294.2
Burma	34.5
India	374.4
Indonesia	1,345.7
Japan	74.2
Malaysia	526.0
New Zealand	174.6
Pakistan	439.8
Taiwan, China	38.2
Thailand	187.2
Total	**4,379.6**
AFRICA	
Algeria	2,316.5
Angola	15.1
Egypt	225.8
Gabon	3.2
Libya	182.0
Morocco	1.7
Nigeria	135.0
Tunisia	13.0
Total	**2,892.3**
COMMUNIST	
China	515.2
Romania	1,236.6
USSR	28,145.0
Other	1,054.1
Total	**30,950.9**
WORLD TOTAL	**74,224.8**

Where discoveries have been drilled in the ultradeepwater gulf



Map key	Block	Operator	Water depth (ft)	Map key	Block	Operator	Water depth (ft)	Map key	Block	Operator	Water depth (ft)
1	AT 1	Texaco	2,443	29	GC 54*	Texaco	1,843	57	MC 349	Exxon	1,158
2	EB 209	BP	1,126	30	GC 629	Marathon	2,089	58	MC 400	Amoco	1,450
3	EB 579	Pennzoil	2,604	31	GC 153	Marathon	2,251	59	MC 401	Amoco	1,473
4	EW 436	Exxon	1,130	32	GC 184	Marathon	2,347	60	MC 441	Chevron	1,298
5	EW 966	Texaco	1,849	33	GC 362	Unocal	2,760	61	MC 443	Unocal	1,440
6	EW 1010	Texaco	1,798	34	GC 366	Exxon	2,500	62	MC 486	Mobil	1,263
7	GB 161	Pennzoil	1,017	35	GC 384	Unocal	2,159	63	MC 487	Mobil	1,418
8	GB 378	Exxon	2,415	36	GC 385	Unocal	2,146	64	MC 489	Mobil	1,195
9	GB 432	Shell	1,734	37	GC 386	Chevron	2,498	65	MC 490	Amoco	*
10	GB 427	Shell	2,701	38	GC 428	Unocal	2,500	66	MC 491	Shell	1,107
11	GB 431	Shell	1,906	39	GC 430*	Unocal	2,498	67	MC 492	Mobil	1,160
12	GC 27	Agip	1,903	40	GC 472	Unocal	2,502	68	MC 535	Mobil	1,140
13	GC 28	Placid	1,472	41	MC 27	BP	2,341	69	MC 711	Shell	858
14	GC 33	Placid	1,859	42	MC 28	BP	2,731	70	MC 712	Exxon	962
15	GC 205	Placid	1,902	43	MC 111	Exxon	2,943	71	MC 839	Unocal	1,148
16	GC 64	Shell	1,072	44	MC 151	Shell	1,888	72	VK 780	Shell	1,040
17	GC 65	Shell	1,246	45	MC 194	Shell	2,321	73	VK 783	Shell	1,181
18	GC 86	Amerada Hess	1,438	46	MC 195	Shell	2,781	74	VK 826	Amerada Hess	1,194
19	GC 205	Exxon	1,862	47	MC 280	Exxon	2,304	75	VK 826	BP	1,386
20	GC 72	Mobil	1,980	48	MC 281	Exxon	2,572	76	VK 867*	Unocal	1,200
21	GC 74	Shell	2,013	49	MC 281*	Texaco	2,731	77	VK 868*	Unocal	1,200
22	GC 75*	TXP	2,270	50	MC 474	Exxon	2,113	78	VK 914*	Unocal	1,201
23	GC 90	Exxon	1,810	51	MC 520	Exxon	1,658	79	VK 964	Texaco	1,114
24	GC 108	Agip	1,576	52	MC 564	Exxon	1,207	80	VK 965	Shell	1,201
25	GC 109	Shell	1,753	53	MC 652	Exxon	1,114	81	VK 966	Shell	1,301
26	GC 110	Marathon	1,901	54	MC 653	Shell	1,152	82	VK 967	Amoco	1,417
27	GC 116	Shell	2,526	55	MC 697	Exxon	1,246	83	VK 968	BP	1,116
28	GC 136	BP	1,027	56	MC 698	Exxon	1,114	84	VK 969	BP	1,132

Abbreviations: AT, Atwater Valley; EB, East Breaks; EW, Ewing Bank; GB, Garden Banks; GC, Green Canyon; MC, Mississippi Canyon; VK, Viosca Knoll.

*Wells with Under 4 designation, not necessarily commercial, in more than 1,000 ft of water as of Oct. 30.
Lease has expired.
Source: Minerals Management Service

Further enhancing the economics of the trend is the presence of a secondary target—the shallow Miocene gas trend. Besides the confidence in Norphlet economics based on current prices, there is a perception among operators that gas prices have started to recover. That's likely to further encourage the large upfront capital outlays required to play the Norphlet trend.

Another incentive to explore and develop Norphlet prospects is the approaching expiration of leases this year.

Operators expect activity in the region to continue building in the coming years, barring a plunge in gas prices.

What's been done

Activity in the Norphlet trend slowed after the 1986 oil and gas price collapse as companies revamped strategies in an area where dry hole costs are $13-16 million/well and completed well costs $25 million.

Some operators pulled out of the trend. Phillips Petroleum Co., for example, sold all of its Norphlet acreage to partners.

Operators that stayed, however, are ready to move forward in the trend.

One reason for the renewed activity is that operators have

International Active Rig Count

Region	1982	1983	1984	1985	1986	1987 Land	1987 Off	1987 Total	1988 Land	1988 Off	1988 Total	1989 Land	1989 Off	1989 Total
NORTH AMERICA														
Canada	200	201	259	311	178	179	2	181	194	2	196	129	1	130
United States*	3,117	2,229	2,429	1,976	970	816	120	936	784	152	936	747	123	870
Subtotal	**3,317**	**2,430**	**2,688**	**2,287**	**1,148**	**995**	**122**	**1,117**	**978**	**154**	**1,132**	**876**	**124**	**1,000**
LATIN AMERICA														
Argentina	67	73	82	81	47	60	1	61	63	0	63	54	1	55
Bolivia	11	8	6	5	4	6	0	6	5	0	5	6	0	6
Brazil	94	83	70	76	77	35	25	60	28	11	39	21	7	28
Chile	7	6	6	6	6	4	3	7	2	3	5	3	2	5
Colombia	23	18	16	21	17	14	0	14	19	0	19	15	0	15
Costa Rica	0	1	1	0	0	1	0	1	0	0	0	0	0	0
Ecuador	6	5	4	2	3	3	0	3	5	1	6	5	0	5
Mexico	202	187	196	196	163	112	31	143	121	34	155	69	34	103
Peru	23	16	17	12	13	11	4	15	6	5	11	6	4	10
Trinidad	13	10	9	10	11	5	4	9	3	4	7	2	4	6
Venezuela	69	41	30	33	29	9	9	18	15	10	25	18	10	28
Other	7	3	2	1	1	1	0	1	0	0	0	0	0	0
Subtotal	**522**	**451**	**439**	**443**	**371**	**261**	**77**	**338**	**267**	**68**	**335**	**199**	**62**	**261**
FAR EAST														
Australia	33	25	34	31	15	13	3	16	14	5	19	7	7	14
Bangladesh	5	2	4	5	5	5	0	5	2	0	2	4	1	5
Brunei	10	10	9	7	5	0	3	3	1	3	4	1	3	4
Burma	32	36	33	33	33	29	0	29	26	0	26	23	0	23
China-offshore	10	10	9	14	7	0	4	4	0	8	8	0	4	4
India	50	56	57	62	70	94	22	116	106	25	131	110	25	135
Indonesia	92	88	82	80	62	25	12	37	33	11	44	36	10	46
Japan	22	20	18	16	15	10	0	10	11	0	11	6	0	6
Malaysia	13	10	9	8	8	0	8	8	0	9	9	1	11	12
New Zealand	1	2	2	4	4	2	1	3	1	1	2	2	0	2
Pakistan	17	17	17	18	17	14	0	14	13	0	13	13	0	13
Papua New Guinea	0	1	1	2	1	2	0	2	3	0	3	2	1	3
Philippines	14	8	3	2	1	2	0	2	3	1	4	6	1	7
Taiwan	4	5	6	7	7	2	2	4	2	2	4	4	1	5
Thailand	8	13	11	9	4	3	3	6	3	3	6	3	3	6
Other	0	0	0	0	0	0	0	0	0	1	1	0	1	1
Subtotal	**311**	**303**	**295**	**298**	**254**	**201**	**58**	**259**	**218**	**69**	**287**	**218**	**68**	**286**
AFRICA														
Algeria	61	54	27	35	41	40	0	40	32	0	32	24	0	24
Angola	11	12	7	11	7	1	9	10	0	10	10	1	7	8
Congo	6	4	3	3	2	0	3	3	0	2	2	0	1	1
Gabon	12	7	6	7	3	0	3	3	3	2	5	3	3	6
Kenya	0	0	0	0	0	1	0	1	1	0	1	3	0	3
Libya	31	24	26	30	20	12	0	12	14	2	16	13	4	17
Nigeria	27	17	11	10	10	6	5	11	7	6	13	10	4	14
South Africa	2	2	2	3	3	0	3	3	0	4	4	0	3	3
Tunisia	11	7	6	4	3	3	1	4	2	1	3	3	0	3
Other	27	20	17	15	8	3	0	3	3	2	5	3	2	4
Subtotal	**208**	**147**	**105**	**118**	**97**	**66**	**24**	**90**	**62**	**29**	**91**	**59**	**24**	**83**
EUROPE														
Austria	9	9	7	7	6	4	0	4	4	0	4	3	3	6
Denmark	2	5	3	4	3	0	3	3	0	2	2	0	2	2
France	22	17	20	22	15	8	0	8	8	0	8	7	0	7
Germany, Fed. Rep.	31	25	19	20	19	12	0	12	9	0	9	8	0	8
Greece	5	3	4	1	0	2	0	2	2	0	2	1	0	1
Holland	21	17	18	24	15	3	7	10	4	10	14	4	8	12
Italy	38	26	26	40	33	20	6	26	17	7	24	17	5	22

International active rig count—continued

Region	1982	1983	1984	1985	1986	1987 Land	1987 Off.	1987 Total	1988 Land	1988 Off.	1988 Total	1989 Land	1989 Off.	1989 Total
Norway	13	10	10	13	12	0	12	12	0	15	15	0	12	12
Spain	12	8	9	10	7	2	0	2	1	1	2	1	2	3
United Kingdom	58	42	60	63	43	4	40	44	5	52	57	4	42	46
Yugoslavia	24	21	25	27	30	28	3	31	28	3	31	29	3	32
Other	2	2	2	2	1	0	1	1	0	1	1	0	0	0
Subtotal	**237**	**185**	**203**	**233**	**184**	**83**	**72**	**155**	**78**	**91**	**169**	**73**	**74**	**147**
MIDDLE EAST														
Abu Dhabi	41	35	29	21	15	3	6	9	2	5	7	2	4	6
Dubai	3	7	7	5	3	0	2	2	0	3	3	0	3	3
Egypt	36	35	36	37	33	14	9	23	11	10	21	6	12	18
Iran	3	13	20	20	18	18	0	18	18	0	18	20	0	20
Iraq	11	23	19	28	21	10	0	10	23	0	23	26	0	26
Jordan	0	3	3	2	2	2	0	2	2	0	2	3	0	3
Kuwait	4	5	5	6	6	6	0	6	6	0	6	4	0	4
North Yemen	0	0	0	1	4	4	0	4	3	0	3	2	0	2
Oman	12	11	12	13	13	10	0	10	9	0	9	13	0	13
Qatar	5	3	2	3	1	1	0	1	2	1	3	1	2	3
Saudi Arabia	29	26	16	11	6	4	1	5	3	1	4	4	1	5
Syria	15	15	23	26	27	22	0	22	24	0	24	24	0	24
Turkey	34	26	24	25	27	26	0	26	20	1	21	20	0	20
Other	7	4	1	3	2	1	0	1	0	0	0	1	0	1
Subtotal	**200**	**206**	**197**	**201**	**178**	**121**	**18**	**139**	**123**	**21**	**144**	**126**	**22**	**148**
Total	**4,795**	**3,722**	**3,927**	**3,580**	**2,232**	**1,727**	**371**	**2,098**	**1,726**	**432**	**2,158**	**1,551**	**374**	**1,925**

* U.S. offshore includes inland water rigs: 24 in 1987, 30 in 1988, 19 in 1989. Source: Baker Hughes Inc.

International seismic crew count

	1984 Land	1984 Marine	1984 Total	1985 Land	1985 Marine	1985 Total	1986 Land	1986 Marine	1986 Total
	(Average crews operating)								
United States	441	47	488	319	45	364	161	22	183
Canada	82	5	87	86	4	90	53	1	54
Mexico	32	0	32	32	0	32	29	0	29
Central & South America	79	9	88	64	8	72	48	5	53
Europe	81	35	116	78	35	113	65	26	91
Middle East	36	2	38	40	2	42	33	4	37
Africa	53	6	59	55	6	61	44	4	48
Far East	85	12	97	92	9	101	74	9	83
Total	**889**	**116**	**1,005**	**766**	**109**	**875**	**507**	**71**	**578**

	1987 Land	1987 Marine	1987 Total	1988 Land	1988 Marine	1988 Total	1989* Land	1989* Marine	1989* Total
	(Average crews operating)								
United States	154	24	178	147	29	176	105	22	127
Canada	58	1	59	69	1	70	66	0	66
Mexico	23	0	23	21	0	21	19	0	19
Central & South America	46	5	51	53	4	57	54	4	58
Europe	52	25	77	49	26	75	42	26	68
Middle East	35	3	38	42	2	44	42	2	44
Africa	37	5	42	36	6	42	43	8	51
Far East	87	9	96	75	11	86	75	16	91
Total	**492**	**72**	**564**	**492**	**79**	**571**	**446**	**78**	**524**

*First half
Source: Society of Exploration Geophysicists

Horizontal-well survey may point the way to

THE 133 MEDIUM-RADIUS AND LONG-RADIUS WELLS listed in the horizontal-well survey table accompanying this article are examples of technology that may portend the way reservoirs will be drilled and completed in the future.

The drilling of short-radius wells is also increasing.

This technology currently is limited to about 500-ft laterals, but design improvements in tools may soon allow extending the drain holes to at least 1,000 ft. The horizontal-well survey table does include some wells with horizontal lengths in the reservoir less than 1,000 ft. These are shown because they were part of a larger development program or because the data were made available.

Surge in activity

The survey illustrates that horizontal drilling, although some of the technology dates back to the 1920s, has gained widespread acceptance only in the last 4 years. From 1978 through 1984, only one well per year is listed. In 1985, drilling increased to four wells.

Then, in 1986 and 1987, a sharp increase to 28 and 29 wells per year occurred, this was followed by wells-per-year more than doubling to 63 in 1988.

One survey by Eastman Christensen, including wells with less than 1,000-ft drains, indicates that about 200 horizontal wells were drilled in 1988, and this number would double to about 400 in 1989. Historically, through mid-1988, Eastman Christensen estimates that about 470 short-radius, 75 medium-radius, and 68 long-radius wells have been drilled. Over 150 of the short-radius wells were drilled by Texas Eastern Drilling Systems Inc. (Tedsi), now assimilated by Eastman Christensen in the early 1980s.

Alberta Oil sands Technology and Research Authority (Aostra) has been active in a number of pilot projects in Canada that used horizontal holes. These wells also had less than 1,000-ft. horizontal laterals. Ensearch Exploration is another company that drilled a short-radius well in 1988. (PE)

Helder field — production increase

	Production in original well		Production in horizontal sidetrack	
Well No.	bo/d	water cut, %	bo/d	water cut, %
A-2	422	96.7	586	70.5
A-3	441	95.7	1,260	18.0
A-4	—	—	2,090	1.4
A-5	585	94.2	2,036	1.0
A-7	546	95.0	1,343	5.3
A-8	363	95.8	1,837	47.4
A-10	695	93.8	1,887	2.9
A-11	816	91.3	1,768	9.8
A-12	551	96.1	2,556	10.7
B-1	571	84.0	1,279	14.0
P/9-6	340*	—	4,400	—

* Production in exploration well

Horizontal wells planned for 1989 (wells drilled with over a 1,000-ft horizontal lateral in the reservoir)

Company	No. of wells	Location
AGIP	1	Adriatic Sea
Alcorn International	1	Galoc field, offshore Phillipines
Amoco Production	1-2	Netherlands, and the Austin Chalk in Texas
Arco Alaska	6	Prudhoe Bay and Lisburne fields, Alaska
Atlantic Richfield Indonesia	6	Bima field, Java Sea
BP Exploration	1	Cyrus field, UKCS Block 16/28
Chevron	2 1	Cabinda, Angola Bakersfield, Calif.
CS Resources	5-10	Canada
Elf Aquitaine	5	Rospo Mare fields
Hungarian National Petroluem and Gas Trust	1	Kiskundorozsma field, Hungary
Husky Oil	1	Rainbow Lake in NW Alta., Canada
Maersk Olie Og Gas	3-6	Dan, Tyra, and Valdemar fields offshore Denmark
Meridian Oil	+30	Mostly in the Williston basin and some in the San Juan basin
Mobil	3	Canada, Texas, and North Sea
Norsk Hydro	1	Troll field, North Sea
Stewart Petroleum	1	Alkali Lake field
Shell International Petroleum Maatschappij	+10	Denmark, Malaysia, Gabon, Netherlands, Canada
Union Pacific Resources	6	Burleson Co., Tex.
Unocal Netherlands	2	Offshore Netherlands
Total wells	87-96	

Horizontal well survey

Company	Field, location	Well number	Present status of the well*	Current	Total days this well cost, to date	True vertical depth, ft	Hor. zontal displacement, ft	Max. imum hole angle, degrees	Length drilled horizontally in vertical vert. ft	Length of pay, ft	Top drive	Maximum building rate, degrees	Mud type
Alberta En	Suffield, Alta	5I	P	11 87	36	3,074	1,326	95 10	942	620	Yes	28 30m	IBM
Alberta En	Suffield, Alta	11V	C	2 89	13	3,051	3,408	90 60	2,149	2,149	No	8 6 30m	PM
Amoco Prod	Liuhua 11-1, S. China Sea	6	T	1 89	43	3,988	3,779	92 30	2,124	2,010	Yes	9 100 ft	LTox, OBM
Amoco Prod	Giddings, Tex	10 wells	P	85-88	n a	7,500 9,000	475 2,400	90 0 135 0	475 2,655	475 2,220	Yes No	28 30 m 27 100 ft	IBM n a
ARCO Indonesia	Arjuna, Java Sea	ZUC-9	P	4 86	11	2,649	2,989	89 20	1,755	1,755	No	6 53 100 ft	SW, GEL
ARCO Indonesia	Arjuna, Java Sea	ZUC-6	F	6 86	22	2,656	1,790	90 10	1,067	954	No	9 100 ft	SW, GEL, PM
ARCO Indonesia	Arjuna, Java Sea	ZUF-7	SI	7 86	21	2,663	2,208	86 70	1,010	497	No	5 3 100 ft	SW, BRINE
ARCO Indonesia	Arjuna, Java Sea	PE-7	P	8 87	24	3,021	2,772	88 00	1,701	1,621	No	17 2 100 ft	SW, GEL
ARCO Indonesia	Arjuna, Java Sea	PB-7	P	9 87	19	2,987	2,091	91 60	1,176	1,114	No	9 41 100 ft	SW, LG
ARCO Indonesia	Arjuna, Java Sea	PF-6	P	9 87	14	3,029	1,170	88 00	400	284	No	9 62 100 ft	SW, PRE GEL
ARCO Indonesia	Arjuna, Java Sea	ZUB-9	P	3 88	13	2,680	2,091	91 40	427	427	No	6 82 100 ft	SW, GEL
ARCO Indonesia	Arjuna, Java Sea	ZUC-3	P	7 88	16	2,656	3,168	91 10	1,663	1,663	No	6 39 100 ft	SW, GEL
ARCO Indonesia	Bima, Java Sea	ZUC-4	F	5 86	27	4,113	857	86 70	801	357	No	9 6 100 ft	SW, GEL, PM
ARCO Indonesia	Bima, Java Sea	ZUE-6ST	SI	6 86	62	2,678	4,535	92 40	1,805	867	No	4 27 100 ft	SW, BRINE
ARCO Indonesia	Bima, Java Sea	ZUG-8	P	7 86	18	2,673	1,463	81 30	182	164	No	9 100 ft	SW, PM
ARCO Indonesia	Bima, Java Sea	ZUE-3	P	7 86	20	2,650	2,956	91 60	1,789	1,789	No	6 93 100 ft	SW, NAT, LG
ARCO Indonesia	Bima, Java Sea	ZUE-4	P	7 86	19	2,670	2,179	89 50	872	862	No	6 34 100 ft	SW, LG
ARCO Indonesia	Bima, Java Sea	ZUG-2	SI	7 86	20	2,631	2,866	99 0	1,560	1,263	No	8 1 100 ft	SW, GEL, PM
ARCO Indonesia	Bima, Java Sea	ZUD-4	P	7 86	23	2,668	2,906	92 60	966	720	No	13 100 ft	SW, GEL
ARCO Indonesia	Bima, Java Sea	ZUD-3	SI	8 86	5	2,670	2,364	85 70	968	568	No	7 36 100 ft	SW, PM
ARCO Indonesia	Bima, Java Sea	ZUG-1	P	9 86	16	2,660	4,401	95 70	1,768	1,703	No	6 47 160 ft	SW, GEL, PM
ARCO Indonesia	Bima, Java Sea	ZUA-9	P	4 86	26	2,677	3,707	89 50	1,845	1,845	No	5 55 100 ft	SW, GEL, LG
ARCO Indonesia	Bima, Java Sea	ZUA-4	P	10 86	16	2,668	3,458	94 10	1,222	1,222	No	4 8 100 ft	SW, CLAY, LG
ARCO Indonesia	Bima, Java Sea	ZUA-8ST	P	12 86	18	2,692	2,283	92 60	1,006	1,006	No	9 26 100 ft	SW, LG
ARCO Indonesia	Bima, Java Sea	ZUB-4	P	1 87	16	2,666	3,080	91 80	1,846	1,845	No	7 6 100 ft	SW, GEL
ARCO Indonesia	Bima, Java Sea	ZUA-7	P	10 88	16	2,654	3,720	91 10	2,531	2,531	No	6 6 100 ft	SW, LG
ARCO Indonesia	Bima, Java Sea	ZUG-3	P	12 88	11	2,679	3,712	91 10	1,747	1,747	No	7 02 100 ft	SW, LG
ARCO Indonesia	Bima, Java Sea	ZUG-7	P	12 88	10	2,673	2,349	91 80	1,231	1,231	No	8 46 100 ft	SW, NAT
Arco Alaska	Prudhoe Bay, DS 18	18	P	12 88	41	8,569	1,139	90 80	2,576	1,268	No	5 6 100 ft	OBM
BP Expl	Cyrus, UKCS	11	S	4 83	46	8,419	6,542	91 60	2,526	2,526	Yes	3 40 m	LTox, OBM
CS Res	Pelican, Alta	14-10A	P	2 88	12	1,345	2,689	93 00	1,470	n a	n a	3 10 m	PM
CS Res	Pelican, Alta	14-10B	P	3 88	10	1,345	2,648	92 70	1,703	n a	n a	3 10 m	PM
CS Res	Pelican, Alta	14-10C	P	4 88	9	1,345	2,576	93 20	1,641	n a	n a	3 10 m	PM
CS Res	Pelican, Alta	14-10D	P	4 88	9	1,345	2,763	92 00	1,641	n a	n a	3 10 m	PM
CS Res	Pelican, Alta	11-15A	P	7 88	8	1,345	2,713	92 40	1,641	n a	n a	3 10 m	PM
CS Res	Pelican, Alta	11-15B	P	7 88	7	1,345	2,717	91 50	1,641	n a	n a	3 10 m	PM
CS Res	Pelican, Alta	11-15C	P	8 88	9	1,345	2,799	96 50	1,641	n a	n a	3 10 m	PM
CS Res	Pelican, Alta	11-15D	P	8 88	10	1,345	2,592	92 50	1,654	n a	n a	3 10 m	PM
CS Res	Winter, Sask	B1A6	P	10 88	19	2,133	3,196	92 60	1,864	n a	n a	3 10 m	PM
CS Res	Winter, Sask	A9-29B14	P	10 88	9	2,133	2,690	94 20	1,762	n a	n a	3 10m	PM
Conoco	Elkhorn Ranch, N D	Federal 12-1	P	5 88	125	10,520	2,079	93 00	1,200	300	No	13 6 100 ft	OBM
Conoco	North Sunshine, Wyo	Way No 4	P	11 87	43	3,611	1,330	87 50	1,100	850	No	20 100 ft	Air Mist
Elf	Castet Lou, France	110	P	10 83	139	9,389	4,160	90 50	1,112	984	No	1 9 10 m	IBM
Elf	Chateurenard, France	136	P	3 86	53	1,903	2,769	91 20	1,106	1,106	Yes	2 3 10 m	PM, Supn
Elf	Lacq, France	90	P	6 80	48	2,198	2,195	97 00	902	837	No	2 2 10 m	PM
Elf	Lacq, France	91	SI	4 81	68	2,205	2,720	93 00	1,549	1,549	No	3 3 10 m	PM
Elf	Lacq Superieur, France	LA 414	C	10 88	47	2,165	1,171	94 70	1,847	1,171	No	2 9 10 m	Water, HEC
Elf	Rospo Mare, Off, Italy	6	P	5 82	87	4,524	4,278	96 50	1,978	1,355	No	3 10 m	SW
Elf	Rospo Mare, Off, Italy	211	P	9 86	59	4,472	3,801	98 20	1,811	1,683	Yes	2 3 10 m	SW
Elf	Rospo Mare, Off, Italy	212	P	11 86	45	4,462	3,570	96 00	1,604	1,485	Yes	1 9 10 m	SW
Elf	Rospo Mare, Off, Italy	214	P	1 87	44	4,515	3,311	91 60	1,837	1,631	Yes	2 3 10 m	SW
Elf	Rospo Mare, Off, Italy	213	P	2 87	42	4,485	3,570	91 00	2,165	2,165	Yes	2 7 10 m	SW
Elf	Rospo Mare, Off, Italy	215	P	4 87	58	4,475	3,734	89 90	1,939	1,939	Yes	2 2 10 m	SW
Elf	Rospo Mare, Off, Italy	105 Z	C	12 88	52	4,167	4,249	90 40	1,618	1,181	Yes	2 3 10 m	SW

Reason for horizontal drilling	Completion	Anticlinal dip	Spacing acres	Pay thickness ft	Permeability md	Viscosity cp	Temperature F	Reservoir rock	Main reservoir before gas/oil	Oil production b/d	Water production b/d	Gas production Mcf/d
WC	CL	RP	3	49	1,000.0	100	90	SS	None	126	0	n.a
WC	UL	RP	3	49	1,000.0	100	90	SS	None	126	0	n.a
WC	UL	ESP	n.a	220-2,000	1,000	60	126	LS	TS	n.a	n.a	n.a
WC	CL	RP	3	41	1,000.0	100	90	SS	None	126	0	n.a
IF	n.a	RP	80	n.a	0.1	n.a	n.a	LS,Ch	F	n.a	n.a	n.a
GC,WC	SL	ESP	60	118	4,000.0	32	155	C	Vugs	494	212	185
GC,WC	SL	ESP	60	110	4,000.0	32	155	C	Vugs	314	104	1,856
GC,WC	SL	ESP	60	142	4,000.0	32	155	C	Vugs	71	12	1,193
GC,WC	SL	ESP	20	81	1,500.0	5	178	C	Vugs	35	1,226	21
GC,WC	SL	ESP	20	120	1,500.0	5	178	C	Vugs	229	1,493	61
GC,WC	SL	ESP	60	52	1,500.0	5	178	C	Vugs	152	1,452	66
GC,WC	SL	ESP	60	66	4,000.0	32	155	C	Vugs	350	136	40
GC,WC	SL	ESP	60	105	4,000.0	32	155	C	Vugs	461	115	172
GC,WC	SL	ESP	60	120	4,000.0	32	155	C	Vugs	363	156	1,095
GC,WC	SL	ESP	60	146	4,000.0	32	155	C	Vugs	57	25	3,878
GC,WC	SL	ESP	60	94	4,000.0	32	155	C	Vugs	567	378	121
GC,WC	SL	ESP	60	142	4,000.0	32	155	C	Vugs	229	56	111
GC,WC	SL	ESP	60	103	4,000.0	32	155	C	Vugs	116	26	92
GC,WC	SL	ESP	60	97	4,000.0	32	155	C	Vugs	162	36	1,097
GC,WC	SL	ESP	60	82	4,000.0	32	155	C	Vugs	433	464	109
GC,WC	SL	ESP	60	100	4,000.0	32	155	C	Vugs	287	1,146	116
GC,WC	SL	ESP	60	64	4,000.0	32	155	C	Vugs	339	626	80
GC,WC	SL	ESP	60	65	4,000.0	32	155	C	Vugs	673	791	49
GC,WC	SL	ESP	60	62	4,000.0	32	155	C	Vugs	393	168	44
GC,WC	SL	ESP	60	60	4,000.0	32	155	C	Vugs	360	127	34
GC,WC	SL	ESP	60	63	4,000.0	32	155	C	Vugs	414	138	56
GC,WC	SL	ESP	60	84	4,000.0	32	155	C	Vugs	747	132	48
GC,WC	SL	ESP	60	97	4,000.0	32	155	C	Vugs	831	235	187
GC,WC	SL	ESP	60	77	4,000.0	32	155	C	Vugs	567	378	123
PI,TOC	SL	None	160	30	n.a	n.a	190	SS	SS	1,000	0	750
TOC	SL	n.a	250	105	200.0	1	234	US	n.a	6,200	n.a	n.a
Econ	SL	MP	20	16	n.a	n.a	n.a	S	Nil	n.a	n.a	n.a
Econ	SL	MP	20	16	n.a	n.a	n.a	S	Nil	n.a	n.a	n.a
Econ	SL	MP	20	16	n.a	n.a	n.a	S	Nil	n.a	n.a	n.a
Econ	SL	MP	20	16	n.a	n.a	n.a	S	Nil	n.a	n.a	n.a
Econ	SL	MP	20	16	n.a	n.a	n.a	S	Nil	n.a	n.a	n.a
Econ	SL	MP	20	16	n.a	n.a	n.a	S	Nil	n.a	n.a	n.a
Econ	SL	MP	20	16	n.a	n.a	n.a	S	Nil	n.a	n.a	n.a
Econ	SL	MP	20	16	n.a	n.a	n.a	S	Nil	n.a	n.a	n.a
n.a	SL	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
PI	SL	Rec	n.a	39	n.a	n.a	n.a	S	n.a	n.a	n.a	n.a
PI	SL	None	160	8	n.a	n.a	n.a	Sh	F	55	0	18
IR	SL	RP	10-20	155	77.0	420	110	SS	DS	60	20	None
PI,SC	SL	RP	15	656	0.5	2	n.a	Cal	F	250	n.a	n.a
SC	SL	LSRP	40	23	1,000.0	40	n.a	US	Sh	300	n.a	n.a
PI	SL	ESP	7	229	1.0	17	n.a	C	F	20	2,000	n.a
PI	SL,CL	n.a	7	312	1.0	17	n.a	C	F	20	2,000	n.a
St. inj.	IT	n.a	22	295	1.0	17	129	LS	n.a	n.a	n.a	n.a
CRW	SL	LSRP	n.a	58	0.0	250	n.a	Cal,K	F	1,300	n.a	n.a
CRW	SL	LSRP	n.a	394	0.0	250	n.a	Cal,K	F	2,400	n.a	n.a
CRW	OH	LSRP	n.a	394	0.0	250	n.a	Cal,K	F	3,500	n.a	n.a
CRW	OH	LSRP	n.a	394	0.0	250	n.a	Cal,K	F	8,000	n.a	n.a
CRW	OH	n.a	n.a	394	0.0	250	n.a	Cal,K	F	2,900	n.a	n.a
CRW	OH	n.a	n.a	394	0.0	250	n.a	Cal,K	F	7,100	n.a	n.a
PI	OH	n.a	120	492	1,000-10,000	250	149	KL	TM,LF	3,650	n.a	n.a

Horizontal well survey (continued)

Country	Field, location	Well number	Present status of the well*	Comple tion date	Total days drill ing and com pleting	True vertical depth, ft	Hori zontal displa cement, ft	Max imum angle from vertical, degrees	Length drilled horizon tally in reser voir, ft	Length of pay, ft	Top	Size	Maximum build rate, degrees	Mud type
Elf	Zuidwal, Off, Nether	ZDW A6	GP	4 88	66	6 329	4 981	91 00	2 136	1 493	Yes		2 1 10 m	KCL
Elf	Zuidwal, Off, Nether	ZDW A9	GP	10 88	61	6 349	3 353	93 70	1 759	1 178	Yes		3 10 m	KCL
Elf	Zuidwal, Off, Nether	ZDW A8	GP	11 88	66	6 339	2 346	96 00	2 001	1 509	Yes		2 4 10 m	KCL
Esso Res	Cold Lakes, Alta	Pilot 1	P	78	42	1 558	2 045	90 20	1 059	n a	No		4 3 100 ft	OMB
Esso Res	Cold Lakes, Alta	Pilot 2	P	84	38	1 558	4 721	93 00	3 416	n a	No		4 5 30 m	FW, GEL
Esso Res	Norman Wells, N W T	J-29X	PLA	79	48	1 542	4 921	91 00	3 333	n a	No		6 0 30 m	OMB
Esso Res	Norman Wells, N W T	I-50X	WI	85	24	1 782	5 000	90 00	1 017	n a	No		6 0 30 m	FW, GEL
Esso Res	Norman Wells, N W T	K-50X	P	12 86	38	1 896	5 010	93 00	4 013	n a	No		5 9 100 ft	FW, GEL, PM
Esso Res	Norman Wells, N W T	E-50X	P	5 87	39	1 795	5 013	87 00	3 409	n a	No		6 3 100 ft	FW, GEL, PM
Maersk	Dan, Off, Denmark	MFB-14B	P	6 87	109	6 364	5 663	88 10	1 754	1 279	Yes		4 84 100 ft	FW, GEL, PM
Maersk	Dan, Off, Denmark	MFB-13	P	5 88	69	6 180	4 949	91 60	3 546	3 155	Yes		6 54 100 ft	FW, GEL, PM
Maersk	Dan, Off, Denmark	MFB-15	P	4 88	90	6 270	8 714	91 90	3 742	3 558	Yes		5 18 100 ft	FW, GEL, PM
McCormick	Athens, Pa	Vanderhoff 1	TH	88	n a	n a	n a	n a	n a	n a	n a		n a	n a
Mccormick	Mondak, N D	Federal 14-14	TH	89	n a	n a	n a	n a	n a	n a	n a		n a	n a
Mark Prod	Giddings, Tex	Massey Graves #2	PMP	7 88	35	7 975	700	91 40	All	Unknown	No		n a	FW, PM
Meridian	Basin Fruitland Coal, N M	Sunray H#201	C	89	14	3 230	1 854	94 00	1 008	1 088	Yes		13 35 100 ft	LS, ND
Meridian	Basin Fruitland Coal, N M	SJ 32-5 Unit #100	C	89	14	2 995	1 600	97 00	1 135	1 135	Yes		14 42 100 ft	LS, ND
Meridian	Bicentennial, N D	31-35H	C	1 89	45	10 675	2 653	90 00	2 653	2 653	No		13 100 ft	OBM
Meridian	Bicentennial, N D	33-19H	F	6 88	78	10 796	1 533	90 00	1 533	1 533	No		13 100 ft	OBM
Meridian	Cinnamon Creek, N D	31-7H	F	12 88	51	10 667	2 399	90 00	2 399	2 399	No		13 100 ft	OBM
Meridian	E Lookout Butte, Mont	34-1H	F	11 88	37	8 827	1 347	90 00	1 347	1 347	No		13 100 ft	OBM
Meridian	E Lookout Butte, Mont	12-1H	F	6 88	39	8 811	1 436	90 00	1 436	1 436	No		13 100 ft	OBM
Meridian	E Lookout Butte, Mont	34-36H	F	9 88	43	8 939	1 617	90 00	1 617	1 617	No		13 100 ft	OBM
Meridian	Elkhorn Ranch, N D	33-11H	F	11 87	116	10 420	2 603	90 00	2 603	2 603	No		13 100 ft	OBM
Meridian	Elkhorn Ranch, N D	44-23H	F	10 88	47	10 340	2 692	90 00	2 692	2 692	No		13 100 ft	OBM
Meridian	Elkhorn Ranch, N D	34-29H	F	7 88	64	10 458	1 305	90 00	1 305	1 305	No		13 100 ft	OBM
Meridian	Hay Draw, N D	32-33H	F	11 88	58	10 535	2 571	90 00	2 571	2 571	No		13 100 ft	OBM
Meridian	Pennel, Mont	13-11H	C	12 88	59	9 080	2 599	90 00	2 595	2 595	No		13 100 ft	OBM
Meridian	Pierre Creek, N D	43-36H	P	9 88	66	10 792	3 372	90 00	3 372	3 372	No		13 100 ft	OBM
Meridian	Roosevelt, N D	41-27H	F	12 88	56	10 233	1 112	90 00	1 112	1 112	No		13 100 ft	OBM
Mobil	Lower Spraberry, Tex	John Snowden 7	TH	88	n a	n a	n a	n a	n a	n a	n a		n a	n a
Petrobras	Fazenda Belem, Brazil	9-FZB-446D-CE	P	9 88	20	1 253	2 904	94 00	2 031	853	No		15 5 m	SW
Sceptre Res	North Tangleflags, Sask	n a	P	88	n a	1 500	1 300	n a	1 300	1 300	n a		n a	n a
Shell	FRB West, Malaysia	126	P	10 88	56	6 920	5 791	92 70	1 300	1 100	Yes		3 100 ft	OBM
Standard	AWP, Tex	Braune Wiesing 1	PL	3 86	106	10 300	5 670	96 70	1 845	456	Yes		4 100 ft	OBM
Standard	Calvin-Dean, Tex	M V Bryans A-7	PLA	2 86	49	8 384	n a	95 00	341	341	No		2 1 100 ft	Foam
Standard	Endicott, Off, Alaska	L-28	P	3 88	58	10 091	9 586	85 00	1 000	869	Yes		3 5 100 ft	OBM
Standard	Endicott, Off, Alaska	N-22	P	7 87	64	10 100	5 707	90 00	1 450	1 477	Yes		2 5 100 ft	PM
Standard	Endicott, Off, Alaska	K-34	P	12 87	69	10 180	8 090	86 00	1 640	802	Yes		2 5 100 ft	PM
Standard	Prudhoe Bay, Alaska	E-25	P	1 88	38	9 048	4 851	98 00	1 160	1 210	No		2 5 100 ft	OBM
Standard	Prudhoe Bay, Alaska	Y-25	P	12 88	43	9 035	7 446	92 50	1 918	1 802	No		2 5 100 ft	OBM
Standard	Prudhoe Bay, Alaska	G-23	P	1 87	25	9 054	2 375	86 00	941	520	Yes		4 100 ft	IBM
Standard	Prudhoe Bay, Alaska	Z-33	GI	89	n a	n a	n a	n a	n a	n a	n a		2 5 100 ft	OBM
Standard	Prudhoe Bay, Alaska	J-25	P	8 87	30	8 999	3 152	94 00	2 170	2 126	Yes		4 100 ft	OBM
Standard	Prudhoe Bay, Alaska	F-23	P	12 86	41	9 063	6 086	89 00	1 160	980	No		2 5 100 ft	OBM
Standard	Prudhoe Bay, Alaska	J-X2	P	11 85	48	8 994	4 878	92 00	1 612	1 615	Yes		3 100 ft	Salt
Standard	Prudhoe Bay, Alaska	G-29	P	10 86	36	9 026	4 677	93 00	1 596	1 463	Yes		4 100 ft	OBM
Standard	Prudhoe Bay, Alaska	Y-8A	P	9 88	60	9 044	7 100	88 00	960	1 058	No		10 100 ft	OBM
Standard	Prudhoe Bay, Alaska	G-27	P	9 86	28	9 049	2 748	86 00	973	390	Yes		3 4 100 ft	IBM
Standard	Prudhoe Bay, Alaska	E-28	P	10 87	32	9 080	5 120	97 00	1 427	755	Yes		3 5 100 ft	IBM
Standard	Prudhoe Bay, Alaska	B-3B	P	8 87	38	9 009	4 315	91 00	1 021	869	No		8 100 ft	OBM
Standard	Prudhoe Bay, Alaska	W-42	GI	7 88	33	6 820	3 978	88 00	2 099	1 669	Yes		2 5 100 ft	OBM
Standard	Prudhoe Bay, Alaska	Y-20	P	5 86	33	9 000	9 515	91 00	1 196	1 163	Yes		2 5 100 ft	OBM
Standard	Prudhoe Bay, Alaska	B-30	SI	3 86	37	9 023	5 984	92 00	1 596	1 622	Yes		2 5 100 ft	Salt
Stewart Pet	Alkali Lake, Colo	Schock Fed 1	E	9 88	22	4 186	1 751	90 40	1 641	963	No		10 100 ft	OBM
Unocal	Helder, Off, Nether	A-2	P	1 88	19	4 716	1 910	89 30	479	146	Yes		7 1 30 m	LTox OBM
Unocal	Helder, Off, Neth	A-3	P	12 87	17	4 706	1 639	91 60	869	265	Yes		11 30 m	LTox OBM
Unocal	Helder, Off, Neth	A-4	P	12 86	33	4 709	2 759	91 60	440	134	Yes		10 6 30 m	LTox OBM
Unocal	Helder, Off, Neth	A-5	P	4 87	12	4 731	3 323	90 70	1 348	411	Yes		7 4 30 m	LTox OBM
Unocal	Helder, Off, Neth	A-7	P	3 87	15	4 719	4 089	91 60	1 093	333	Yes		9 30 m	LTox OBM
Unocal	Helder, Off, Neth	A-8	P	4 88	14	4 716	4 998	92 20	0	246	Yes		7 9 30 m	LTox OBM
Unocal	Helder, Off, Neth	A-10	P	6 88	15	4 723	2 437	90 70	1 240	378	Yes		11 1 30 m	LTox OBM
Unocal	Helder, Off, Neth	A-11	P	6 88	11	4 708	1 865	91 10	738	225	Yes		9 2 30 m	LTox OBM
Unocal	Helder, Off, Neth	A-12	P	7 88	12	4 701	2 796	94 50	1 355	413	Yes		5 38 30 m	LTox OBM
Unocal	Helder, Off, Neth	B-1	P	5 87	17	4 737	1 365	92 60	689	177	Yes		13 7 30 m	LTox OBM
Unocal	P 9, Off, Neth	P 9-6	S	12 87	45	6 819	1 831	89 50	1 335	407	Yes		3 9 2 30 m	LTox OBM
Union Pac	Austin Chalk, Tex	Court 2	C	12 88	40	~7 600	~1 500	92 00	1 650	1 650	No		20 100 ft	Water CRW
Western Min	North Herald, Australia	3	P	10 87	n a	3 940	2 389	n a	n a	n a	n a		n a	n a
Western Min	South Pepper, Australia	6	P	12 87	n a	4 047	3 603	n a	n a	n a	n a		n a	n a
Western Min	South Pepper, Australia	7	P	12 87	n a	4 044	3 619	n a	n a	n a	n a		n a	n a

*Core reservoir. †Initial recent.

Reason for horizontal drilling	Completion	Artificial lift	Spacing, ac/well	Pay thickness, ft	Permeability, md	Viscosity, cp	Temperature, °F	Reservoir rock	Main reservoir heterogeneity	Oil production, bbl/d	Water production, bbl/d	Gas production, Mscf/d
PI	SL	None	62	131	15.0	n.a.	n.a.	SS	None	n.a.	n.a.	84,700
PI	SL	None	62	131	15.0	n.a.	n.a.	SS	None	n.a.	n.a.	49,400
PI	SL	None	62	131	15.0	n.a.	n.a.	SS	None	n.a.	n.a.	56,400
PI	SL	RD	n.a.	157	n.a.	n.a.	n.a.	SS	None	n.a.	n.a.	n.a.
PI	SL	GL	n.a.	157	n.a.	n.a.	n.a.	SS	None	n.a.	n.a.	n.a.
Topo	SL	GL	n.a.	300	n.a.	n.a.	n.a.	LS	F	n.a.	n.a.	n.a.
Topo	CL	INJ	n.a.	300	n.a.	n.a.	n.a.	LS	F	n.a.	n.a.	n.a.
Topo	CL	GL	n.a.	300	n.a.	n.a.	n.a.	LS	F	n.a.	n.a.	n.a.
Topo	CL	GL	n.a.	300	n.a.	n.a.	n.a.	LS	F	n.a.	n.a.	n.a.
PI	CL	GL	40	250-300	0.5-1	1	167	Ch	TL	627	35	359
PI	CL	n.a.	40	300-400	0.5-1	1	167	Ch	TL	3,031	9	8,440
PI	CL	n.a.	40	400	5-1	1	167	Ch	TL	2,949	6	4,099
	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
IFS	SL PKR	RP	33	n.a.	n.a.	n.a.	60	Ch	F	12	50	260
IFS	n.a.	n.a.	320	20	n.a.	n.a.	n.a.	Coal	F, Cleat	n.a.	n.a.	n.a.
IFS	n.a.	n.a.	320	20	n.a.	n.a.	n.a.	Coal	F, Cleat	n.a.	n.a.	n.a.
IFS	SL	n.a.	160	4-12	1.0	0	240	Sh	F	n.a.	n.a.	n.a.
PI	SL	None	160	4-12	1.0	0	240	Sh	F	443	1	172
IFS	SL	None	160	4-12	1.0	0	240	Sh	F	125	0	109
Low perm	OH	RP	160	4-12	1.0	2	190	C	Low perm	115	205	65
Low perm	SL	RP	160	4-12	1.0	2	190	C	Low perm	221	55	110
Low perm	SL	RP	160	4-12	1.0	2	190	C	Low perm	178	83	89
IFS	SL	None	160	4-12	1.0	0	240	Sh	F	298	0	299
IFS	SL	None	160	4-12	1.0	0	240	Sh	F	95	n.a.	50
PI	SL	None	160	4-12	1.0	0	240	Sh	F	332	n.a.	167
IFS	SL	None	160	4-12	1.0	0	240	Sh	F	148	0	142
Low perm	OH	RP	160	4-12	1.0	2	190	C	Low perm	n.a.	n.a.	n.a.
IFS	SL	0	160	4-12	1.0	0	240	Sh	F	254	0	209
IFS	SL	None	160	4-12	1.0	0	240	Sh	F	160	0	98
n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
PI	SL	RP	10	48	4,000.0	1,600.0	105	US	Sh	189	56	n.a.
WC	SL	RP	n.a.	100	n.a.	n.a.	n.a.	US	n.a.	n.a.	n.a.	n.a.
PI	CL	n.a.	n.a.	55	n.a.	1	180	SS, Sh	Sdy Sh	4,000	1,000	n.a.
Pilot	SL	None	n.a.	430	1.20	n.a.	256	S	Faulting	n.a.	n.a.	n.a.
Pilot	OH	RP	n.a.	10	0.20-03	n.a.	155	S, Sh	F, Disc Sh	4.5	5-6	0.3
CRG	SL, CL	None	160	340	2,000-500*	1	219	SS	Disc Sh	6,446,680[1]	0.0	900,722
CRG	CL, Perf	None	160	340	2,000-500*	1	219	SS	Disc Sh	10,193,2,880[1]	30.6	849,678
CRG	CL, Perf	None	160	340	2,000-500*	1	219	SS	Disc Sh	6,268,3,109[1]	6,340.7	791,640
CRG	CL, Perf	GLA	80	216	45.17*	1	200	SS	Disc Sh	10,800,9,060[1]	1,840.6	782,726
CRG	SL, CL	GLA	160	88	124.55*	1	200	SS	Disc Sh	5,600	18	656
CRG	CL, Perf	GLA	80	206	45.17*	1	200	SS	Disc Sh	3,180,4,770[1]	9,710.4	671,296
Inj	SL	None	160	n.a.	26.9*	1	200	SS	Disc Sh	Gas inj		
CRG	SL, CL	GLA	80	220	186.85*	1	200	SS	Disc Sh	12,700,4,590[1]	0.0.5	699,2,116
CRG	CL, Perf	GLA	80	213	45.17*	1	200	SS	Disc Sh	4,840,3,710[1]	2,403.4	671,715
CRG	SL, CL	GLA	80	265	186.85*	1	200	SS	Disc Sh	11,680,1,030[1]	3,222.2	614,1,650
CRG	CL, Perf	GLA	80	213	45.17*	1	200	SS	Disc Sh	10,700,3,160[1]	1,110.8	788,4,123
CRG	SL, CL	GLA	160	72	124.55*	1	200	SS	Disc Sh	4,800,2,010[1]	1,112.2	859,942
CRG	CL, Perf	GLA	80	211	45.17*	1	200	SS	Disc Sh	5,900,4,430[1]	2,502.4	945,2,892
CRG	CL, Perf	GLA	80	196	45.17*	1	200	SS	Disc Sh	14,650,3,650[1]	0,860.7	697,2,421
CRG	SL, CL	GLA	80	137	143.64*	1	200	SS	Disc Sh	8,230,2,390[1]	911.5	6,018,6,864
Inj	SL	None	160	n.a.	26.9*	1	200	SS	Disc Sh	Gas inj		
CRW	SL	GL	80	100	124.55*	1	200	SS	Disc Sh	2,300,2,060[1]	730.71	533,533
CRW	SL, CL	GLA	80	137	143.64*	1	200	SS	Disc Sh	9,651,1,600[1]	25,443.2	605,7,108
IFS	n.a.	Swab	n.a.	216	n.a.	n.a.	n.a.	Sh Sr Cb	Hum	n.a.	0	na
Sweep, WC	PGPL	ESP	62	89	3,000.0	30	143	SS	Fly hum	580	1,400	n.a.
Sweep, WC	PGPL	ESP	62	108	3,000.0	30	143	SS	Fly hum	1,260	415	n.a.
Sweep, WC	PGPL	ESP	62	82	3,000.0	30	143	SS	Fly hum	2,090	30	n.a.
Sweep, WC	PGPL	ESP	62	85	3,000.0	30	143	SS	Fly hum	2,036	20	n.a.
Sweep, WC	PGPL	ESP	62	82	3,000.0	30	143	SS	Fly hum	1,343	76	n.a.
Sweep, WC	PGPL	ESP	62	59	3,000.0	30	143	SS	Fly hum	1,847	1,055	n.a.
Sweep, WC	PGPL	ESP	62	85	3,000.0	30	143	SS	Fly hum	1,887	50	n.a.
Sweep, WC	PGPL	ESP	62	79	3,000.0	30	143	SS	Fly hum	1,268	190	n.a.
Sweep, WC	PGPL	ESP	62	102	3,000.0	30	143	SS	Fly hum	2,556	306	n.a.
Sweep, WC	PGPL	ESP	62	56	3,000.0	30	143	SS	Fly hum	1,270	208	n.a.
PI, IFS	PGPL	None	n.a.	941	0.1	3	167	FS	DP, TM	4,400	0	n.a.
IFS	SL	RP	80	94	Nat Frac	n.a.	n.a.	C Sh	F	n.a.	n.a.	n.a.
n.a.	SL	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
n.a.	SL	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
n.a.	SL	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Additional horizontal well survey information

Company	Field location	Well number	Measure-ment tool type	Distance into reservoir type	Oil viscosity	Open hole logs run	Post drilling survey type
Alberta En	Suffield, Alta	5I	MWD	None	PD	GR TDT	None
Alberta En	Suffield, Alta	11M	MWD	None	LT	GR	None
Amoco Prod	Liuhua 11-1, S. China Sea	A	MWD	15% HCI	LT	RES, R, N, GR	SDL/AMR
Amoco Prod	Giddings, Tex	10 wells	MWD	n a	None	Typically none	None
ARCO Indonesia	Arduna, Java Sea	ZUC-9	MWD, GR	Acid	n a	None	
ARCO Indonesia	Arduna, Java Sea	ZUC-8	MWD	Acid	TLC	GR, MSFL, LDL, CNL, NGS, BHC, AMS	None
ARCO Indonesia	Arduna, Java Sea	ZUF-7	MWD	Acid	TLC	CBL, ZDL, CET, GR, BHC, MSFL, GR, LDL, CNL, NGS	None
ARCO Indonesia	Arduna, Java Sea	PF-7	MWD, GR	Acid	n a	n a	None
ARCO Indonesia	Arduna, Java Sea	PB-7	MWD, SS	Acid		n a	None
ARCO Indonesia	Arduna, Java Sea	PF-6	MWD	Acid	WAD	WAD	None
ARCO Indonesia	Arduna, Java Sea	ZUC-7	MWD	Acid	TLC	GR, LDL, CNL, MSFL, S	None
ARCO Indonesia	Arduna, Java Sea	ZUC-7	MWD, GR	Acid	n a	n a	None
ARCO Indonesia	Bima, Java Sea	ZUC-4	MWD	Acid	TLC	GR, LDL, CNL, NGS, BHC, AMS, MSFL	None
ARCO Indonesia	Bima, Java Sea	ZUE-6ST	MWD, GR	n a	TLC	GR, LDL, CNL, ZDL, BHC, MSFL, C, DIL, AMS	None
ARCO Indonesia	Bima, Java Sea	ZUD-8	MWD	Acid	TLC	CET, GR, LDT, MSFL, CNL, NGT, BHC, AMS, CBL, VDL, CET	None
ARCO Indonesia	Bima, Java Sea	ZUB-3	MWD	Acid	TLC	GR, BHC, MSFL, CAL, SP, GR, LDL, CNL, NGS, AMS, DIPT	None
ARCO Indonesia	Bima, Java Sea	ZUE-4	MWD	Acid	TLC	GR, GR, BC, VDL, CET, MSFL, LDL, CNL, NGS, BHC, AMS	None
ARCO Indonesia	Bima, Java Sea	ZUD-2	MWD, SS	Acid	TLC	GR, BHC, GR, NGS, MSFL, LDL, CNL, Temp, CNL, CBT, AMS, CBL, VDL	None
ARCO Indonesia	Bima, Java Sea	ZUD-4	MWD	Acid	TLC	CPT, BHC, GR, MSFL, LDL, CNL, NGS, AMS	None
ARCO Indonesia	Bima, Java Sea	ZUD-3	MWD, GR	Acid	TLC	GR, MSFL, NGT, LDT, CET, GR, SP, C	None
ARCO Indonesia	Bima, Java Sea	ZUD-1	MWD	Acid	TLC	GR, GR, LDL, MSFL, CNL, NGS, X, DIP, SP	None
ARCO Indonesia	Bima, Java Sea	ZUA-9	MWD	Acid	TLC	GR, BHC, LDL, CNL, MSFL, GR, NGS	None
ARCO Indonesia	Bima, Java Sea	ZUA-4	MWD, GR	Acid	TLC	CET, BHC, GR, SP, GR, C, MSFL, DLL, LDL, CNL, CBL	None
ARCO Indonesia	Bima, Java Sea	ZUA-8ST	MWD, GR	Acid	TLC	CET, BHC, GR, SP, GR, C, DIL, MSFL, LDL, CNL, C	None
ARCO Indonesia	Bima, Java Sea	ZUB-4	MWD	Acid	TLC	SP, GR, LDL, CAL, CNL, GR, C	None
ARCO Indonesia	Bima, Java Sea	ZUA-7	MWD	n a	n a	n a	None
ARCO Indonesia	Bima, Java Sea	ZUD-5	MWD	n a	n a	n a	None
ARCO Indonesia	Bima, Java Sea	ZUD-6	MWD	n a	n a	n a	None
Arco Alaska	Prudhoe Bay, DS 18	18	MWD	None	VIS	GR, X, N, C	None
BP Exp	Cyrus, UKCS	11	MWD	n a	MWD	EWR, GR, CNL, C	n a
CS Res	Pelican, Alta	14-10A	MWD	n a	n a	n a	n a
CS Res	Pelican, Alta	14-10B	MWD	n a	n a	n a	n a
CS Res	Pelican, Alta	14-10C	MWD	n a	n a	n a	n a
CS Res	Pelican, Alta	14-10D	MWD	n a	n a	n a	n a
CS Res	Pelican, Alta	11-15A	MWD	n a	n a	n a	n a
CS Res	Pelican, Alta	11-15B	MWD	n a	n a	n a	n a
CS Res	Pelican, Alta	11-15C	MWD	n a	n a	n a	n a
CS Res	Pelican, Alta	11-15D	MWD	n a	n a	n a	n a
CS Res	Walter, Sask	B1A6	MWD	n a	n a	n a	n a
CS Res	Walter, Sask	A1-28B14	MWD	n a	n a	n a	n a
Conoco	Eklutna Kenai N.E.	Federal 1-1	MWD	None	None	None	None
Conoco	North Cuyama, Wy	Mary N. 3	None	Direct Acid	n a	None	None
EP	Cadeby Dp, France	110	MWD, GR	None	n a	n a	
EP	Chateauneuf, France	136	n a	Acid	LT	GR, MWD	
EP	Lacq, France	90	n a, GR	Acid	HEV	GR	
EP	Lacq, France	91	MWD, GR	Acid	MWD	DIL, GR, SP, CBL, VDL, CNL	
EP	Lacq Supérieur, France	LA-414	MWD, GR	Chemical	LT, MWD	DIL, MSFL, GR, BHC, AMS, CNL	None, Sonic
EP	Rospo Mare, Off. Italy	6	MWD, GR	Acid	MWD	DIL, SP, BHC, DIL, GR	
EP	Rospo Mare, Off. Italy	7H	MWD	Acid	MWD	DIL, DLL, GR, SP, BHC, CNL, NGT, MWD	
EP	Rospo Mare, Off. Italy	11	MWD, GR	Acid	MWD	MWD, MWD, GR, SP, BHC, CNL, NGT, MWD, MWD	
EP	Rospo Mare, Off. Italy	14	MWD, GR	Acid	MWD	DIL, MWD, GR, SP, NGT, BHC, GR, AMS, GR	
EP	Rospo Mare, Off. Italy	15	MWD, GR	Acid	MWD	DIL, MWD, LDT, NGT, BHC, GR, AMS, GR	
EP	Rospo Mare, Off. Italy	21D	MWD, GR	Acid	MWD	DIL, CNL, NGT, GR, AMS, GR	
EP	Rospo Mare, Off. Italy	21P-2	CT	HEV	MWD	DIL, CNL, NGT, GR, AMS	None
EP	Zuidwal, Off. Nether.	ZUA-A6	MWD, RSS	n a	MWD	DIL, MSFL, LDT, CNL, NGS, BHC, GR, AMS	Sonic, Inclinometer, MWD, GR, CET

Additional horizontal well survey information — (continued)

Company	Field, location	Well number	Measured depth (MD)	Stimulation type	Log type	Open hole logs	Cased hole logs
Elf	Zuidwal, Off, Nether.	ZDW A9	MWD, RGD	None	TLC	DIS, MSFL, LDT, CNL, NGL, SLS, GPIT, AMS	FLOW, THERMO, MAND, GR, CCL
Elf	Zuidwal, Off, Nether.	ZDW A8	MWD, RGD	None	TLC	DIS, MSFL, LDT, CNL, NGL, SLS, GPIT, AMS	FLOW, THERMO, MAND, GR, CCL
Esso Res.	Cold Lake, Alta.	Pilot 1	GWS	Acid	None	None	n/a
Esso Res.	Cold Lake, Alta.	Pilot 2	MWD, SS	Acid	None	None	n/a
Esso Res.	Norman Wells, N.W.T.	J-29X	MWD, GR	Acid	DP	Standard suite	n/a
Esso Res.	Norman Wells, N.W.T.	I-50X	n/a	Acid	DP	Standard suite	n/a
Esso Res.	Norman Wells, N.W.T.	K-50X	n/a	Acid	DP	Standard suite	n/a
Esso Res.	Norman Wells, N.W.T.	F-50X	n/a	Acid	DP	Standard suite	n/a
Maersk	Dan, Off, Denmark	MFB 14R	MWD, SS	Propped acid fracs	TLC	DIL, LDL, CNL, GR, CAL	CET, spinner survey
Maersk	Dan, Off, Denmark	MFB 13	MWD, SS	Acid fracs	TLC	LDL, CNL, DIL, SDT, GR, CAL, RFT	CBL, CET
Maersk	Dan, Off, Denmark	MFB 15	MWD, SS	Acid fracs	TLT	LDL, CNL, DIL, SDT, GR, CAL, RFT	CET
McCormick	Athens, Pa.	Vanderlip # 1	n/a	n/a	n/a	n/a	n/a
McCormick	Minnek, N.D.	Federal 14-14	n/a	n/a	n/a	n/a	n/a
Mark Prod.	Giddings, Tex.	Massey Graves #2	ST	None	None	None	None
Meridian	Basin Fruitland Coal, N.M.	Surrey # 201	MWD	n/a	n/a	n/a	n/a
Meridian	Basin Fruitland Coal, N.M.	SJ 42-5 Unit # 106	MWD	n/a	SLS /	n/a	n/a
Meridian	Bicentennial, N.D.	41-1H	MWD	None	None	None in lateral	None
Meridian	Bicentennial, N.D.	33-1H	MWD	None	None	None in lateral	None
Meridian	Cinnamon Creek, N.D.	31-1H	MWD	None	None	None in lateral	None
Meridian	E. Lookout Butte, Mont.	44-1H	MWD	None	None	None in lateral	None
Meridian	E. Lookout Butte, Mont.	12-1H	MWD	None	None	None in lateral	None
Meridian	E. Lookout Butte, Mont.	34-36H	MWD	None	None	None in lateral	None
Meridian	Elkhorn Ranch, N.D.	33-1H	MWD	None	None	None in lateral	None
Meridian	Elkhorn Ranch, N.D.	44-2H	MWD	None	None	None in lateral	None
Meridian	Elkhorn Ranch, N.D.	34-2H	MWD	None	None	None in lateral	None
Meridian	Hay Draw, N.D.	42-33H	MWD	None	None	None in lateral	None
Meridian	Pennel, Mont.	13-1H	MWD	None	None	None in lateral	None
Meridian	Pierre Creek, N.D.	44-36H	MWD	None	None	None in lateral	None
Meridian	Roosevelt, N.D.	41-27H	MWD	None	None	None in lateral	None
Mobil	Lower Spraberry, Tex.	John Snowden #1	n/a	n/a	n/a	n/a	n/a
Petrobras	Fazenda Belem, Brazil	1-FZB-44D-CE	MWD	n/a	TLC	DIL, LSS, CNS, GR, RFT, BHC, VDL, CBL	n/a
Sceptre Res.	North Tangleflags, Sask.	n/a	n/a	n/a	n/a	TLC	n/a
Shell	FRB, Asst, Malaysia	324	MWD, GR	Acid	TLC	IES, LDT, CNL, BHC, GR, VDL, GR	CET
Standard	AWP, Tex.	Brazos Wedding 1	MWD, Dir. Rec.	None	TLC	GR, DIL, CNL, LSS	None
Standard	Larsen Dean, Tex.	W.V. Bryson A-1	None	Frac	None	None	None
Standard	Endicott, Off, Alaska	L-28	MWD	None	MWD, TLC	GR, EWR, SFD, CBT	None
Standard	Endicott, Off, Alaska	N-22	MWD	None	MWD, TLC	GR, EWR, N	CBL/VDL
Standard	Endicott, Off, Alaska	K-33	MWD	None	MWD, TLC	GR, EWR, GR, CBT	None
Standard	Prudhoe Bay, Alaska	E-25	MWD	None	MWD, TLC	GR, EWR, N, CBT, CET	None
Standard	Prudhoe Bay, Alaska	Y-25	MWD	None	MWD	GR, EWR, N	None
Standard	Prudhoe Bay, Alaska	U-23	MWD	None	MWD, TLC	GR, R, CBT, CET, CNC	CBL/VDL/GR/CCL
Standard	Prudhoe Bay, Alaska	Z-33	MWD	None	MWD	GR	None
Standard	Prudhoe Bay, Alaska	J-27	MWD	None	MWD, TLT	GR, R, CET	None
Standard	Prudhoe Bay, Alaska	F-23	MWD	None	MWD, TLC	GR, R, EWR, CBT, CET, CNL	None
Standard	Prudhoe Bay, Alaska	L-32	MWD	None	MWD	GR	CET/GR/Temperature
Standard	Prudhoe Bay, Alaska	U-29	MWD	None	MWD, TLC, ST	GR, DIL, CNL, SDT, CBT, CET	CET/GR/CCL
Standard	Prudhoe Bay, Alaska	Y-35	MWD	None	MWD	GR, EWR, N	None
Standard	Prudhoe Bay, Alaska	U-21	MWD	None	MWD, TLC	GR, DIL, CNL, SDT	None
Standard	Prudhoe Bay, Alaska	E-25	MWD	None	MWD, TLC	GR, EWR, N, CBT, CET	None
Standard	Prudhoe Bay, Alaska	B-18	MWD	None	MWD, ST	GR, CBT, CET, GR	CET/GR/CCL
Standard	Prudhoe Bay, Alaska	A-42	MWD	None	MWD	GR	None
Standard	Prudhoe Bay, Alaska	R-20	MWD	None	MWD	GR	None
Standard	Prudhoe Bay, Alaska	B-5	MWD	None	MWD, TLC	GR, DIL, SDT, CNL, CBL	CET/GR/CCL
Stewart Pet.	Alkali Lake, Ont.	3 Clark Fed. 3	GR, Dir.	D.N.-X	MWD	Vision, GR	None
Unocal	Helder, Off, Neth.	A-1	MWD	None	None	n/a	None
Unocal	Helder, Off, Neth.	A-3	MWD	None	None	n/a	None
Unocal	Helder, Off, Neth.	A-4	MWD	None	None	n/a	None
Unocal	Helder, Off, Neth.	A-5	MWD	None	None	n/a	None
Unocal	Helder, Off, Neth.	A-7	MWD	None	None	n/a	None
Unocal	Helder, Off, Neth.	A-8	MWD	None	None	n/a	None
Unocal	Helder, Off, Neth.	A-10	MWD	None	None	n/a	None
Unocal	Helder, Off, Neth.	A-11	MWD	None	None	n/a	None
Unocal	Helder, Off, Neth.	A-12	MWD	None	None	n/a	None
Unocal	Helder, Off, Neth.	B-1	MWD	None	None	n/a	None
Unocal	K15, Off, Neth.	K15-FA-1	MWD	None	DIL	MWD/GR	None
Union Pac.	Austin Chalk, Tex.	Guard 2	Dir.	HCl-DA	None	None	None
Western Mining	North Herald, Australia	1	n/a	n/a	n/a	n/a	n/a
Western Mining	South Pepper, Australia	4	n/a	n/a	n/a	n/a	n/a
Western Mining	South Pepper, Australia	7	n/a	n/a	n/a	n/a	n/a

*Continuation of Table 1 (Oil and Gas, Feb. 27, pp. 58)

WORLDWIDE PRODUCTION SYSTEMS

Platform name number and designation	Production system type or function	Material no. legs main piles skirt piles	No. of Wells water depth installation	Current status — Fabrication date	Installation site — site or fabricator
U.S. GULF OF MEXICO					
Anadarko					
Galveston 333 A	Jacket	4 pile/main/ No skirts	66 ft No. of wells Undetermined	Under study	Undetermined
Chevron					
BM 3 SK	Production Satellite	4 piles	6 wells 31 ft	Under Constr Dec. 89	Bay Marchand Blk. 3 Twin Brothers Marine Offshore Specialty Fabricators
EI 229 A	Production	4 piles	No Wells 121 ft	Design	Eugene Island Block 229
EI 229 CA	Well Satellite	4 piles	12 Wells 121 ft	Design	Eugene Island Block 229
MP 299 BA	Production Satellite	4 piles	8 Wells 210 ft	Design	Main Pass Block 299
MU 868 A	Drilling Production	4 piles	8 Wells 129 ft	Design	Mustang Island Block 868
SMI 77 C	Drilling Production	4 piles	6 Wells 137 ft	Design	South Marsh Island Blk. 77
SMI 117 A	Production Satellite	4 piles	6 Wells 192 ft	Under constr Dec. 89	South Marsh Island Blk. 78 Twin Brothers Marine Umtab
SMI 78 B	Drilling Production	4 piles	12 Wells 139 ft	Under constr Oct. 89	South Marsh Island Blk. 78 Twin Brothers Marine Big Mac
SS 100 DA	Production Satellite	4 piles	6 Wells 22 ft	Installed Aug. 89	Ship Shoal Block 100 Twin Brothers Marine Houma Industries
SS 108 D	Production	4 piles	No Wells 30 ft	Installed Aug. 89	Ship Shoal Block 100 Umtab Mosby Enterprises
Conoco					
Joliet GC 184 A	TLWP	Steel 4 0.0	24 1,760 ft	Installed 6.89	FELS Singapore
Marquette GC 52 A	Jacket	Steel 4 0.8	18,615 ft	Installed 7.89	Gulf Marine Ingleside TX
CPP GC 52	Jacket	Steel 4 0.8	0,615 ft	Installed 4.89	Gulf Marine Ingleside TX
Enserch					
A	Jacket		5.95 ft	Planned	A High Island A560
A	Jacket		5,265 ft	Planned	NA Brazos 455
Mobil					
South Marsh Island 205A	Drlg Prod	Steel 4 4	442 ft 9 wells	Installed 9.89	Jacket Piles McDermott Morgan City LA Deck Refurbished Bay Corpus Christi TX
East Cameron 286 #4	Well Protector	Steel 3 3 piles	182 ft 2 slots in 1990	In design to be installed	N.A.
South Marsh Island 243-C Aux	Compressor	Steel 4 legs 4 piles	24 ft no slots	Fabrication in progress 12.89	Jacket by Dolphin Deck refurbished by Dolphin Piles by Teledyne Isby
Mobile Bay 77 F	Drlg Prod	Steel 8 legs	25 ft 8 slots	Fabrication in 1990	Deck only at Bay Corpus Christi
Mobile Bay 823 A	Well protector	Steel 8 legs 8 piles	42 ft 8 slots	In Fabrication mid-91	In fabrication at McDermott Morgan City LA
Shell Auger	Tension leg platform		2,860 ft of water 32 well slots		1993 installation
Union Oil					
W.C. 367	Well Prot 4 Leg Prod Platform		1,84 ft	Fab 1.90	Gulf Island
Zapata					
West Cameron 538 B	Jacket	3.3.0	4,182 ft	Installing 4.89	W. Cameron 538 Delta Engr.
AFRICA					
Nigeria National Petroleum Co					
Numbi GSN	Production and water injection	8 legs piles	42 m 42 m	Fab in progress mid 10.90	Numbi Field (Angola) ETPM Sharjah (U.A.E.)
Wamba GSP	Production platform	8 legs piles	42 m 65 m	Fab in progress mid 10.90	Wamba Field (Angola) ETPM Sharjah (U.A.E.)
Total					
Shoueir	?????	4 legs 4 main pigs	310 – 35 m	?????? Engineering Installation 90	Sauerin (Suez Gulf) Ain Sokna(Egypt)
ALASKA					
Marathon					
Cook Inlet Alaska	74 man living quarters module & helideck – water injection module			Completed 7.89	Sembawang Engineering
AUSTRALIA					
BHP Petroleum					
Challis	Floating Prod		7 wells	Installation 11.89	Timor Sea (Hull Nagova) Japan
Venture	& Storage		105 m		
Skua	FPSO		N.A. 85 m	Pre-feas. Studies N.A.	Timor Sea N.A.
Western Australia Petroleum					
Saladin A	Jacket	Steel 3.3	3.16 meters	Loading out 9.89	West Australia TP.3 (Part 1) Geraldton W.A. Westside Saipem
Saladin B	Jacket	Steel 3.3	3.16 meters	Loading out 9.89	West Australia TP.3 (Part 1) Geraldton W.A. Westside Saipem
Saladin C	Jacket	Steel 3.3	3.2 meters	Fabrication 10.89	West Australia TP.3 (Part 1) Geraldton W.A. Westside Saipem
BRAZIL					
Petrobras					
Enchova Oeste	Jacket (Satellite)	Steel 4 12	27,387	Design 1992	Campos Basin NA
Enchova	Jacket	Steel 8 12	380	Design	Campos Basin NA

Offshore production systems planned,installed in '88 — continued

Platform name number and designation	Production system type or function	Material no. legs main piles skirt piles	No. of Wells water depth Installation	Current status — Fabrication date	Installation site site or fabricator
	(Processing)			1992	
PPE-01	Jacket (Processing)	Steel 4 4 4	59	Planned NA	Pescada Field NA
PPE-01 A	Jacket (Quarters)	Steel 4 4 4	59	Planned NA	Pescada Field NA
PPE-02	Jacket (Satellite)	Steel 4 4 4	4 57	Planned NA	Pescada Field NA
PPE-03	Jacket (Satellite)	Steel 4 4	7 59	Planned NA	Pescada Field NA
PPE-04	Jacket (Satellite)	Steel 4 4 4	4 56	Planned NA	Pescada Field NA
Carapeba-3	Jacket (Satellite)	Steel 4 4	18 300	Planned NA	Campos Basin NA
Marlim Piot (Pxx)	Semi		1970	Bidding NA	Marlim Field NA
PVIII	Semi		3180	Bidding NA	Marlim Field NA
PXVIII	Semi		3180	Design NA	Marlim Field NA
PXIX	Semi		1590	Design NA	Marlim Field NA
Tubarao	Semi		430	Design NA	Santos Basin NA
Albacora-1	Semi		2950	Planned NA	Albacora Field NA
Albacora-2	Semi		1150	Planned NA	Albacora Field NA
Albacora-3	TLP Delta Tower Semi		1935	Planned NA	Albacora Field NA
CANADA					
Husky Oil					
Terra Nova	Floating Production		30 - 310ft	Under study	
JAPAN					
Japan National Oil Corp					
Iwafune-Oki	Self-contained platform	Steel 8 legs Main pile 8 Skirt pile 4	10 wells 36 m	Under constr Sept '90	Japan Sea Fab site Jacket Wakamatsu Deck Ulsan, Korea Fabricator Jacket NSC Deck Hyundai
INDIA					
ONGC					
?????	50-man living quarters module & Helideck			Under Constr	Sembawang Engineering
INDONESIA					
Amoseas Indonesia					
to be named	FPSO	N A	72 m	Under Fab	To be installed at Anoa Field, Natuna Sea FPSO Barge fab at IHI Aichi Works, Japan
Total					
Tambora	Central Processing Unit	830 t 8 piles	3 m	Fabrication Installation in 1990	Cilegon (Fab) Tambora (Installation)
GTS	3 platforms processing	3 x100 t 4 piles each	3 m	Fab Inst in 1990	Handil (Fab) Tambora (Instal)
Wellhead	17 platforms	17 x 15 t 3 piles each	0-10 m	Fab Inst in 1990	Handil (Fab) Tambora (Instal)

Platform name number and designation	Production system type or function	Material no. legs main piles skirt piles	No. of Wells water depth Installation	Current status — Fabrication date	Installation site site or fabricator
MIDEAST					
OGPC					
???No. 3 ???????	2 Living quarters module support frm helideck jacket ????			Under const	Sembawang Engineering
NEW ZEALAND					
Shell					
Maui Platform B	Jacket	(4 20 t)	12 365 ft	Design 1993	NA Maui Field New Zealand
NORTH SEA					
A P Moller					
Dan FA	Wellhead P F	Jacket(4 0 B)	12 138 ft	Start of production April 87	Jackets Nippon Steel Topsides Odense Steel Shipyard, DK Laurtzen McDermott DK
Dan FB	Wellhead P F	Jacket(4 0 B)	12 138 ft		
Dan FC	Process Utility Accommodation	Jacket(4 0 B)	138 ft		
Gorm F	Water injection facilities	Jacket(4 4 4)	125 ft	Planned	
Dagmar	Satellite Wellhead P F	Simple Tripod for Rig installation (START) Minimum Topside Facilities Concept	2 115 ft	Planned	
Kraka	Satellite Wellhead P F	Simple Tripod Adopted for Rig Installation (START) Minimum Facilities Concepts	2 145 ft	Planned	
Amoco Norway					
HOD		Jacket 4	8 230 ft	Under constr June '90	Vlissingen Holland Heerema
BP					
Gyda	PDQ Jacket	Steel 8	32 200 ft	Construction	Ekofisk Field Several Aker Verdal
ETPM					
L7-H	Integrated deck	4 piles	N A 37 m	Completed 1 7 89	Zwijndrecht
Hydrocarbons Great Britain					
DP6	Drilling & Production	4 Legs 12 piles	14 slots 100 ft	Installed April 89	Morecambe Bay Contractors (Press Offshore McDermott)
DP8	Drilling & Production	4 Legs 12 piles	14 slots 100 ft	Installed May '89	Morecambe Bay Contractors (Press Offshore McDermott)
Norsk Hydro					
Oseberg C	PDQ Jacket	Steel 8	8 330 ft	Construction 7 90	Oseberg Field Several Spain
Oseberg 2	Process Module	8 legs	26 wells 110 m	Under constr 2 91	Zwijndrecht
Placid					
L10-G	Wellhead protector	4 piles	1 well	completed 1 5 9	Zwijndrecht

Offshore production systems planned,installed in '88 — continued

Platform name number and designation	Production system type or function	Material no legs main piles skirt piles	No of Wells water depth installation	Current status — Fabrication date	Installation site site or fabricator
Saga					
Snorre-	Tension-leg Phase 1 platform w subsea prod system water injection	Integrated deck Steel 4-column hull 4x4-ft tethers 4 concrete suction anchors Subsea prod System guideless 10 - 10 well slots	44 well slots 10 wells operating 1 2 for water inj	Engineering phase near completion in initial constr phase Total approx 8% of project completed Instal '92	Fab of deck Aker Stord Hull Kvaerner Rosenberg Mating site Stord
Shell Oil					
Draugen	Concrete gravity-based structure prod drlg and quarters	10 cells 1 shaft	10 825 ft	Engineering work in Summer 93	Draugen Field Norwegian Contractors
Draugen	PDQ Mono-tower integrated Deck Main Structure	Concrete 1	12 750 ft	Design 6 91	Hafenbanken NA
Statoil					
Gullfaks C	integrated platform	Concrete	52 716	Installed May '89 Prod End May '89	Norway B× 34 10
Veslefrikk A	Wellhead platform	Steel 4	29 566	Installed May '89	Norway B× 30 3 Aker Verdal
Veslefrikk B	Floating processing platform	Steel hull		Installed Sept '89	Norway B× 30 3 Moss Rosenberg
Sleipner A	Integrated platform	Concrete 4-		Planned installation '92 Production 93	Norway B× 15 8 Concrete Norwegian contractors
Zeepipe riser platform	riser on platform	steel	NA	Planned location not clear yet	Dutch sector for '92 installation
Statfjord East	Subsea template	steel	10 478	Planned installation '93	Norway B× 33 9
Statfjord North	Subsea template	steel	10 480	Planned installation 1993	Norway B× 33 9 Both North & East will be processed on Statfjord C
Sleipner A	Concrete gravity based structure	24 cells 4 shafts	32 272 ft	Under constr Summer 92	Sleipner Field Norwegian Contractors
PEOPLE'S REPUBLIC OF CHINA					
ACP Operators Group					
42-21-1 stack 16 08	Drlg Workover Rig			Under constr	Sembawang Engineering
Japan National Oil Corp					
BZ 34-2 4E FPSO	Floating prod Vessel	Tanker type		Under Constr	Bohai Bay Fab site Shanghai Fabricator BOC
BZ 34 2EP	Wellhead jacket	Steel 4 4 0	7 wells 19 m	Nov 83	Hiroshima Japan NSC
BZ 34 2EW	Wellhead jacket	Steel 4 4 0	9 wells 19 m	Aug 89	Tianjin China BOC
BZ 34-4EP	Wellhead jacket	Steel 4 4 0	6 wells 19 m	May 86	Hiroshima Japan NSC
Lufeng 13-1	Floating Prod Vessel — Wellhead jacket	Tanker type Steel 4 4	146 m	Under study	South China Sea
SOUTHEAST ASIA					
SSB					
Temana CC	Drlg Jacket	4 4	3 92	Planned 1990	N A
Temana W	Drlg Jacket	4 4	6 82	Feb 1990	Malaysia Shipyard & Engineering AY Engineering
Bayan C	Drlg Jacket	4 4	12 90	Planned 1990	N A
D18-B&C	Drlg Jacket	4 4	6 115	Planned 1990	N A
PCSB SSB					
Baker A	Compression platform	4 4	220	Feb 1989	AY Engineering
SSPC					
St Joseph B	Drlg Jacket	4 4	9 120	Feb 1990	Malaysia Shipyard & Engineering Sabah Shipyard
PCSB					
Dulang A	Drlg cttrm	4 4	32 250	Feb 1990	Sime Sembawang Engineering Sabah Shipyard
Dulang B	Integrated drlg & prod platform	8 4	32 250	Feb 1990	Sime Sembawang Engineering Malaysia Shipyard & Engineering Sabah Shipyard
USSR					
Sakhalin Oil Development					
Chayvo Field n Sakhalin (USSR)	Under planning Ice Resistant P F of Gravity Type)		80 ft	Middle 90s	USSR Sakhalin None
Odoptu Field n Sakhalin (USSR)	Under planning Ice resistant P F of Gravity Type)		100 ft	Middle 90s USSR Sakhalin	None
Challis Venture for BHP Petroleum Pty Ltd	FPSO	NA	Water depth 105 m	Fabrication completed	To be installed at Challis Field Timor Sea FPSU Barge fab at IHI Aichi Works Japan
to be named for Amoseas Indonesia	FPSO	NA	Water depth 77m	Under Fabrication	To be installed Anoa Field Natuna Sea FPSO Barge fab at IHI Aichi Works Japan
Zapata					
West Cameron 538 B	Jacket	3 3 0	4 182 ft	Install Wlation 9 89	Cameron 538 Delta Engineering

Mobil has been pursuing long term warranty contracts with LDCs.

Role of aggregator

Pipelines will continue to be the main aggregators in the industry.

The trend is for the gas departments of major integrated companies to assume more of the aggregation role. However, the top eight producers of U.S. gas account for only about 30% of the supply.

Some major producers have undertaken the aggregation role where they buy from third party producers for resale. Many of these transactions, however, involved working interest partners in a particular development project where the operator managed the gas sale for the partners.

Mobil currently is not buying gas from third parties for resale. However, it is part of the company's future plan. There exists a need for producers to build some expertise as aggregators.

Conoco is doing some buying from third party producers for resale in order to learn about the aggregator business and to help keep the system balanced.

Of concern to all in the gas business is the unfinished agenda at the Federal Energy Regulatory Commission.

Gas inventory charges (GICs) and access to firm transportation are two regulatory issues critical to the future of the business.

Under the 1935 Natural Gas Act, pipelines generally had to maintain their service obligations even after the expiration of system supply contracts with end users. FERC's Order 500, however, gives pipelines pregranted abandonment authority when the contracts expire if the end user converts to firm transportation.

The issue is urgent because most pipeline system supply contracts in the U.S. are scheduled to expire in the next couple of years.

Apache has been able to obtain firm transportation only on pipelines where the pipeline's traditional customer has converted service obligation gas to firm transportation.

Pipelines restructure

Federal rule changes also have caused pipelines, which previously generally bought gas from producers for resale, to restructure into separate operations and marketing units.

The operations units generally work to reduce transportation costs and provide a growing range of transportation services, thereby attracting shippers and keeping the pipeline full.

The marketing units, on the other hand, are driven by volume and margin. At some pipelines, the units operate as separate profit centers.

The big restructuring move at most pipelines involved moving the transportation/exchange (T/E) function out of operations and into marketing.

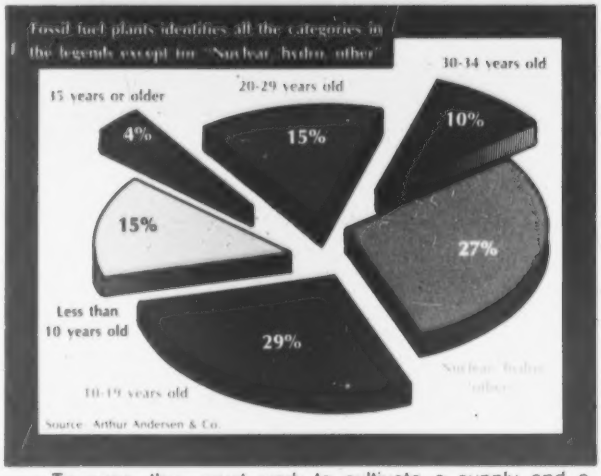
T/E is the group that arranges and accounts for transportation of gas from wellhead to market.

Because most gas today is transported through 30 day transactions, the T/E function is critical. On ANR Pipeline Co.'s system, 80% of the throughput early last year was on 30 day transactions. The pipeline, as did others, struggled to come up with the best method to arrange and reconcile the transactions on a nondiscriminatory basis every 30 days.

One problem is that purchases behind a gas plant might involve fractional interests in hundreds of wells. Division orders and allocation agreements must be structured so that the T/E department can police the transactions.

Another problem for pipelines is the growing practice of producers to shut in discretionary production when spot prices fall. As a transporter, pipelines lose the control they once had.

Electric generating plants are aging



To cope, they must work to cultivate a supply and a market base that has continuity throughout the year.

Arranging transportation

Transportation today generally is being arranged through chaotic monthly nominations to pipeline transport controllers.

At most companies, the nominations are done by telephone. The T/E representative calls a controller and nominates a volume to be transported from point to point.

The call sometimes is to an answering machine, followed with a telecopied nomination. Acceptance is telecopied back. Those involved in the process also must be aware of where bottlenecks occur on the pipeline grid. In such a case, capacity as well as volume is nominated first come, first served.

The goal of transportation departments today is to be the low cost transporter and to make sure that what has been bought gets delivered.

Instead of selling gas, pipelines today are selling capacity.

Capacity is sold through traditional merchant sales and as firm, interruptible, or discounted interruptible transportation.

Another key is developing a service oriented, quick response program that can tell shippers how much it will cost to transport and the time involved.

Other services offered for a price include gathering, processing, transporting, marketing, load balancing, and storage.

Transportation rates

Gas pipeline transportation rates continue to evolve as transmission companies learn to operate as transporters rather than as gas merchants.

It has become clear to many producers, pipelines, and end users that competitive and innovative transportation rates play increasingly important roles in their business. Prior to 1986, contract transportation was limited mainly to special applications on pipelines, such as special purpose pipelines from wellhead to end user.

Most interstate pipelines have had to significantly redesign their rates structure. They mainly have segregated their systems into zones where transportation rates are based upon mileage sensitive cost allocations.

Natural Gas Pipe Line Co. of American (NGPL) segregated itself into what it calls the northern zone and the southern

Worldwide oil and gas at a glance

COUNTRY	ESTIMATED PROVED RESERVES 1-1-90		OIL PRODUCTION			REFINING Capacity on 1-1-90				
	Oil (1,000 bbl)	Gas (bcf)	Producing wells* 12-31-88	Estimated 1989 (1,000 b/d)	% change from 1988	No. of ref.	Crude	Thermal operations	Catalytic cracking	Catalytic reforming
							b/cd			
ASIA-PACIFIC										
Australia	1,676,500	16,467	951	488.8	-5.6	10	675,000		194,700	164,000
Bangladesh	500	12,360	10	0.9		1	31,200			1,650
Brunei	1,375,000	11,370	583	143.3	+3.8	1	10,000			
Burma	51,300	9,430	450	12.0	-20.0	2	32,000	5,200		
China, Taiwan	4,600	840	83	2.6	+4.0	2	570,000	13,500	22,500	56,250
India	7,516,400	22,973	1,866	673.3	+6.0	12	1,079,842	110,670	136,370	26,230
Indonesia	8,200,000	87,015	6,470	1,208.6	+6.2	6	714,200	81,700	12,600	61,500
Japan	60,818	1,116	387	11.3	-8.1	41	4,198,450	85,800	617,225	531,800
Korea, South						6	867,000	48,700		62,450
Malaysia	2,950,000	51,900	467	557.3	+3.2	4	209,300			24,600
New Zealand	146,000	5,120	49	28.0	0.4	1	95,100			26,600
Pakistan	118,563	18,000	80	45.0	-0.9	3	120,925			5,100
Papua New Guinea	200,000	4,520								
Philippines	15,000	10	13	4.0	-33.3	4	283,800		23,100	39,900
Singapore						5	830,000	170,500		61,300
Sri Lanka						1	50,000	12,500		3,750
Thailand	230,670	6,910	245	39.0	+5.4	3	214,850	17,600	15,700	20,750
Total Asia-Pacific	**22,848,261**	**248,831**	**11,884**	**3,214.1**	**+3.1**	**102**	**9,991,887**	**566,170**	**1,022,100**	**1,005,000**
WESTERN EUROPE										
Austria	65,997	400	987	23.3	+4.0	1	204,000	23,426	24,000	32,000
Belgium						4	613,500	62,800	104,700	81,400
Cyprus						1	18,000			4,300
Denmark	849,124	4,450	65	111.0	+15.9	3	186,500	73,670		31,100
Finland						2	241,000	46,300	41,800	42,900
France	189,899	1,180	608	65.3	-3.4	14	1,819,900	152,850	352,500	247,400
Germany, West	400,000	6,640	2,917	74.7	-4.0	16	1,507,200	283,262	182,700	283,300
Greece	72,500	210	11	17.0	24.4	4	384,500	41,120	50,500	46,100
Ireland						1	56,000			11,000
Italy-Sicily	727,103	11,693	193	94.7	+4.2	21	2,803,600	412,900	305,700	334,850
Netherlands	169,800	61,100	289	87.0	+14.5	7	1,380,700	155,600	125,500	178,600
Norway	11,546,204	82,160	223	1,469.8	+33.7	3	295,000	76,000	41,000	46,000
Portugal						3	313,300		10,100	52,200
Spain	25,000	810	44	18.0	37.9	10	1,293,000	174,000	173,300	172,000
Sweden						5	427,500	65,000	25,000	72,000
Switzerland						2	132,000	20,000		26,000
Turkey	520,850	705	625	55.5	+4.9	5	724,654	4,500	34,128	63,127
United Kingdom	4,255,620	20,836	755	1,743.0	23.1	15	1,831,100	157,000	459,000	312,200
Total Western Europe	**18,822,087**	**191,814**	**6,717**	**3,799.3**	**-3.7**	**117**	**14,231,454**	**1,746,428**	**1,989,928**	**2,036,477**
MIDDLE EAST										
Abu Dhabi	92,205,000	182,900	1,001	1,359.0	+18.6	2	180,000			30,100
Bahrain	111,708	6,476	267	42.2	+6.6	1	243,000	20,000	39,000	18,000
Dubai	4,000,000	4,900	150	410.6	+15.6					
Iran	92,860,000	500,000	361	2,934.3	+30.6	4	530,000	80,800		63,845
Iraq	100,000,000	95,000	820	2,830.0	+5.3	8	318,500			43,500
Israel	1,483	9	12	0.3	25.0	2	180,000	67,000	24,000	26,000
Jordan	5,000	58	3	0.3		1	100,000		4,410	8,640
Kuwait	94,525,000	48,600	363	1,542.6	+15.6	4	819,000	54,000	42,000	33,000
Lebanon						2	37,000		7,250	7,492
Neutral Zone	5,200,000	12,000	501	396.6	+26.7					
Oman	4,250,000	9,260	1,093	622.7	+1.2	1	76,932			15,386
Qatar	4,500,000	163,100	174	394.6	+14.1	1	62,000			12,030
Ras al Khaimah	400,000	2,000	6	10.0						
Saudi Arabia	254,959,000	181,347	588	4,935.6	0.2	7	1,007,000	34,000	82,400	167,600
Sharjah	1,500,000	11,000	20	65.0						
Syria	1,730,000	4,000	963	300.6	+17.4	2	243,744	36,384		28,080
Yemen, North	1,000,000	5,500	60	176.6	+11.1	1	10,000			2,500
Yemen, South	3,000,000			10.0		1	161,500			10,800
Total Middle East	**666,247,191**	**1,229,150**	**6,582**	**16,891.8**	**+16.3**	**37**	**3,968,676**	**292,184**	**199,060**	**468,073**

EDITOR'S NOTE: All reserves figures except those for the U.S.S.R. (and gas for Canada) are reported as proved reserves recoverable with present technology and prices. U.S.S.R. figures are "explored reserves" which include proved, probable, and some possible. Canadian gas figure, under criteria adopted by Canadian Petroleum Association in 1980, includes proved and some probable. *Does not include shut-in, injection or service wells. †Estimates based on capacity as of Jan. 1, 1989, plus known 1989 closures and expansions. ‡Includes Albania, Bulgaria, Cuba, Czechoslovakia, East Germany, Hungary, Mongolia, North Korea, Poland, Rumania, Viet Nam, and Yugoslavia.

COUNTRY	ESTIMATED PROVED RESERVES 1-1-90		OIL PRODUCTION			REFINING Capacity on 1-1-90				
	Oil (1,000 bbl)	Gas (bcf)	Producing wells* 12-31-88	Estimated 1989 (1,000 b d)	% change from 1988	No. of ref.	Crude	Thermal operations	Catalytic cracking	Catalytic reforming
							b cd			
AFRICA										
Algeria	9,200,000	114,000	840	698.0	+ 8.9	4	464,700			55,600
Angola-Cabinda	2,024,000	2,100	422	454.7	+ 0.8	1	32,100			1,900
Benin	100,000		6	4.5						
Cameroon	400,000	3,880	175	172.7	- 0.4	1	43,020			6,920
Congo	830,000	2,580	310	150.0	- 11.4	1	21,000			2,000
Egypt	4,500,000	11,720	874	854.3	+ 0.7	8	489,203	16,470		30,940
Ethiopia		800				1	18,000			2,270
Gabon	733,000	560	312	197.3	- 12.7	1	24,000	+ 7,200		1,400
Ghana	1,000					1	26,600			5,850
Ivory Coast	100,000	3,530	17	2.0	81.8	2	69,000			13,600
Kenya						1	95,000			9,000
Liberia						1	15,000			2,000
Libya	22,800,000	25,500	678	1,100.6	- 7.4	3	329,400			14,182
Madagascar		70				1	16,350	7,000		2,600
Morocco	2,500	100	5	0.3	25.0	2	154,600		5,600	26,800
Mozambique		2,290								
Nigeria	16,000,000	87,400	1,513	1,605.3	- 15.6	4	433,250		82,700	70,070
Senegal						1	24,000			2,600
Sierra Leone						1	10,000			
Somalia		210				1	10,000			
South Africa		1,760				4	433,500	63,500	84,400	62,800
Sudan	300,000	3,000				1	25,000			2,100
Tanzania		4,100				1	13,500			3,000
Tunisia	1,750,000	3,100	152	102.0	0.8	1	34,000			3,300
Zaire	96,120	30	107	27.5	5.8	1	17,000			3,500
Zambia						1	24,500			5,600
Total Africa	**68,835,620**	**268,730**	**5,411**	**5,360.2**	**+7.7**	**44**	**2,822,723**	**94,175**	**172,700**	**328,692**
WESTERN HEMISPHERE										
Argentina	2,279,900	27,299	9,061	459.0	- 2.0	11	688,700	125,100	124,800	40,800
Barbados	3,190	7	85	1.2		1	3,000			
Bolivia	182,000	5,475	301	20.3	- 5.7	3	57,500			14,900
Brazil	2,816,000	3,849	6,166	597.1	- 9.1	13	1,397,100	38,300	331,100	21,000
Canada	6,133,495	94,300	38,557	1,588.0	0.6	28	1,851,800	88,250	387,470	372,450
Chile	300,000	4,200	379	23.7	2.9	3	146,800	20,000	38,870	10,000
Colombia	2,060,000	4,020	2,785	405.0	- 6.6	4	227,400	60,000	91,000	6,000
Costa Rica						1	16,200	6,500		1,200
Dominican Republic						2	48,500			9,000
Ecuador	1,514,000	3,990	952	286.6	7.3	5	145,000	21,126	16,000	2,800
El Salvador						1	17,000			3,200
Guatemala	41,600	10	14	3.7		1	16,000			3,000
Honduras						1	14,000			1,800
Jamaica						1	34,200			3,240
Martinique						1	12,000			3,000
Mexico	56,365,000	73,380	3,768	2,618.0	- 0.5	9	1,514,000	82,000	267,000	157,800
Netherlands Antilles						1	320,000	67,000	42,000	15,000
Nicaragua						1	14,800			2,800
Panama						1	100,000			7,500
Paraguay						1	7,500			
Peru	411,979	650	3,478	129.0	9.9	6	172,438		22,540	1,680
Puerto Rico						2	123,000		13,500	26,500
Suriname	28,200		99	3.7	- 8.8					
Trinidad & Tobago	521,000	9,968	3,255	153.7	- 1.9	2	300,000	18,000	28,000	31,000
Uruguay						1	33,000		4,100	2,500
Venezuela	58,504,000	100,846	12,857	1,731.6	- 5.0	6	1,201,100	138,000	193,100	6,000
Virgin Islands						1	545,600	80,000		125,000
United States	25,860,000	165,000	612,448	7,675.6	5.7	188	†16,243,841	†1,914,090	†5,252,900	†3,901,920
Total Western Hemisphere	**197,650,364**	**492,934**	**694,196**	**15,699.2**	**-2.0**	**295**	**25,240,579**	**2,680,366**	**6,612,360**	**4,779,099**
Total non-Communist	**917,471,623**	**2,425,810**	**734,300**	**44,060.8**	**+2.6**	**905**	**68,254,690**	**5,330,218**	**10,136,283**	**8,687,482**
COMMUNIST AREAS										
China	24,000,000	35,300	43,700	2,770.0	+ 1.4	40	2,200,000	NA	NA	NA
U.S.S.R.	58,400,000	1,500,000	145,000	12,150.0	2.4	39	12,300,000	NA	NA	NA
Other§	1,700,000	28,000	NA	391.0	3.9	60	3,298,135	90,430	156,755	171,298
Total Communist	**84,100,000**	**1,563,300**	**188,700**	**15,311.0**	**-1.0**	**139**	**17,798,135**	**90,430**	**156,755**	**171,298**
TOTAL WORLD	**1,001,571,623**	**3,989,110**	**923,000**	**59,369.8**	**+2.1**	**734**	**74,052,824**	**5,420,748**	**10,293,038**	**8,858,780**

Worldwide Production

• Offshore (e) Estimated (c) Condensate (NA) Not available

WORLDWIDE PRODUCTION

		Name of field, discovery date		Depth, ft	No. of wells Producing	No. of wells Total	Production 1988 average B/d	Production Cumulative to Dec. 31, 1988 Bbl	API gravity
ABU DHABI(c)	ADCO, OTHERS		•						
			•						
			•						
			•						
			•						
			•						
			•						
			•						
		Total Abu Dhabi			1,001	1,863	1,145,800	8,878,262,800	
ALGERIA(c)	SONATRACH								
		Total Algeria			840	840	641,000	7,772,386,000	
ANGOLA	FINA ANGOLA								

WORLDWIDE PRODUCTION

		Name of field, discovery date	Depth, ft	No. of wells: Producing	No. of wells: Total	Production: 1988 average B/d	Production: Cumulative to Dec. 31, 1988 Bbl	°API gravity
		Luango, 1977	3,800	3	6	726	2,208,000	38.0
		Lumueno, 1977	4,600	11	23	2,956	4,755,000	37.0
		Mulenvos, 1966	5,900- 6,600	4	16	169	5,072,000	25.0
		N'Zombo, 1973	5,000- 6,300	24	37	11,160	91,606,000	33.0
		Pambo, 1982	4,600	4	4	971	2,034,000	39.0
		Pinda, 1966	6,709		4		3,000	26.0
		Quenguela, 1968	6,000	22	31	1,415	37,631,000	31.0
		Quinfuquena, 1975	6,800- 7,100	14	18	4,439	25,887,000	32.0
		Quinguila, 1972	3,400	20	58	8,054	36,053,000	36.0
		Serena, 1974	6,200	3	4	1,005	1,441,000	27.0
		Tobias, 1961	1,970	1	12	52	28,830,000	31.0
	CHEVRON	• Kali, 1969	11,400-11,660	1	1	187	4,290,615	30.0
		• Kambala, 1971	10,500	5	5	6,147	19,796,132	32.8
		• Kungulo, 1975	4,000	16	17	9,598	46,602,964	32.2
		• Lifuma, 1984	7,800	1	1	34	196,758	31.4
		• Limba, 1979	2,660- 7,350	10	14	10,184	88,824,338	31.6
		• Livuite, 1979	8,000	3	7	260	2,571,343	31.7
		• Malongo North, 1966	1,170- 9,250	58	73	14,134	215,522,413	30.0
		• Malongo South, 1966	1,150- 1,440	29	33	8,374	75,456,179	25.0
		• Malongo West, 1969	1,680- 8,800	23	49	19,245	237,489,069	22.5
		• Numbi, 1980	3,446	21	21	47,163	19,535,314	34.0
		• Takula, 1971	3,070- 9,090	65	72	115,727	197,815,187	31.5
		• Viuko, 1983	3,700	6	6	8,664	10,002,147	35.0
		• Wamba, 1982	2,700	7	7	28,596	19,571,110	29.0
	TEXACO-SONANGOL-TOTAL-BRASPETRO	• Cuntala, 1978	7,200		1	224	2,264,669	31.0
		• Essungo, 1975	6,500	9	12	4,012	20,848,112	35.0
		• Lombo Este, 1983	7,800	9	10	15,432	5,922,941	41.0
		• Sulele Oeste, 1985	7,600	6	6	4,086	1,544,901	41.0
		• Tubarao, 1984	7,600	5	5	8,181	3,726,542	41.0
		• Sulele South 1, 1986	7,600	1	2	1,498	458,332	39.0
	ELF ANGOLA[e]	• Palanca, 1981	8,860	12	23	113,681	99,518,938	40.0
		• Pacassa, 1982	11,500	10	13			38.0
		Total Angola		422	653	451,000	1,328,348,004	
ARGENTINA	YPF	Chubut, 1907	1,908- 9,168	2,261	2,325	86,821	1,030,471,182	21.1-26.0
		Formosa, 1984	11,466-11,490	12	14	7,252	8,173,912	42.0-42.9
		Jujuy, 1969	2,461-16,732	9	9	925	61,270,462	46.5-47.0
		La Pampa, 1968	3,609- 4,921	198	209	10,410	78,879,745	31.0
		Mendoza, 1932	2,178-16,778	1,156	1,187	86,443	1,101,537,904	23.7-32.0
		Neuquen, 1918	1,312-12,498	1,160	1,205	77,166	512,722,915	24.0-41.0
		Rio Negro, 1960	2,953- 7,546	897	937	42,948	457,217,678	22.5-41.0
		Salta, 1928	6,551-15,092	33	43	9,731	123,185,970	29.0-59.0
		Santa Cruz, 1946	1,468-17,060	3,129	3,274	101,326	1,021,663,540	21.1-30.0
		Tierra del Fuego, 1959	5,249- 7,824	206	206	15,895	158,271,370	43.4-46.0
		Total Argentina		9,061	9,409	438,917	4,553,394,678	
AUSTRALIA	BARRACK ENERGY	Mount Horner, 1965	3,800- 5,800	6	10	275	120,650	38.0
	BHP PETROLEUM PTY. LTD	• Jabiru, 1983	4,786	4	4	40,800	27,300,000	42.3
	BOND CORP., PETROLEUM DIVISION	• Harriet, 1983	6,230	10	10	11,400	10,835,000	38.2
	AGL PETROLEUM	Alton, 1964	6,000	4	8	23	1,898,436	49.5
		Anabranch, 1965	4,188				13,718	44.0
		Bennett, 1965	5,960	1	1	4	117,265	45.0
		Cabawin, 1961	10,800	1	1	4	61,381	49.0
		Maffra, 1965	4,251	1	1	14	33,042	48.0
		Metgasco, 1964	4,000	21	36	2,096	3,974,118	48.9
		Moonie, 1961	5,800	19	36	599	21,898,878	44.5
		Richmond, 1963	3,643				16,845	43.0
		Snake Creek, 1964	4,990	1	1	1	13,158	67.0
		Sunny Bank, 1962	6,139					40.0
		Trinidad 1 & 3, 1965	4,599				63,560	46.0
	HARTOGEN ENERGY GROUP	Birah Creek, 1982	4,900	1	4	9	14,965	34.0
		Cranstoun, 1987	4,250	1	1	274	104,115	48.0
		Igundu, 1986	2,700	1	1	64	67,403	43.0
		Kincora, 1980	4,700	5	11	12	300,702	34.0
		Monier, 1987	4,150	1	1	59	27,634	49.0
		Riverslea, 1981	4,950	2	2	102	332,989	37.0
		Sandy Creek, 1982	4,900	1	1	2	8,730	34.0
		Talgeberry, 1985	3,900	2	3	207	243,490	46.0
		Takyah, 1985	3,800	1	1	19	15,573	43.0
		Tarbat, 1988	2,700	1	1	30	10,950	43.0
		Tintaburra, 1984	3,500	5	6	327	544,424	43.0
		Toobunyah, 1985	3,500	4	5	320	315,386	43.0
		Waratah, 1982	5,950	4	5	61	283,970	34.0
		Washpool, 1985	5,250	1	1	1	1,231	35.0
	EROMANGA ENERGY	Blina, 1981	4,400	5	5	323	1,177,614	37.0
		Lloyd, 1987	4,806	1	1	186	82,282	37.0

WORLDWIDE PRODUCTION

	Name of field, discovery date	Depth, ft	No. of wells Producing	No. of wells Total	Production 1988 average B/d	Production Cumulative to Dec. 31, 1988 Bbl	°API gravity
	Sundown, 1983	4,600	2	2	43	280,753	39.0
	West Terrace, 1985	4,800	2	2	46	122,738	33.0
LASMO	Black Stump, 1986	5,360	1	1	69	143,689	45.2
	Bodalla South, 1984	4,800-5,230	6	6	1,771	3,407,102	47.2-48.7
	Glenvale, 1985	4,800	1	1	1	18,128	49.3
	Kenmore, 1985	4,600-5,460	10	11	1,475	2,645,432	48.2-45.8
SANTOS LTD	Alwyn, 1985	5,700	1	1	76	105,000	41.0
	Big Lake, 1984	4,600	3	3	24	370,000	45.0-48.0
	Bogala, 1984	6,300	2	2	165	894,000	40.0
	Brookabourdie, 1985	5,000	1	1	68	80,000	46.0
	Brolga, 1983	4,643	1	1	5	2,646	53.0
	Chatrum, 1984			1		21,000	
	Cheokeo, 1985	6,000	4	5	337	988,000	45.0
	Cook, 1985			1	15	29,000	
	Coorong/Coorong North, 1986		4	5	1,058	860,000	
	Dingera, 1987		1	1	2	1,000	
	Dirkala, 1986	5,000	2	3	245	533,000	56.0
	Dullingari, 1979	5,700	14	30	3,995	7,175,000	54.0
	Fly Lake, 1971	5,430	3	3	55	70,006	53.0
	Gidgealpa, 1964	6,150	42	56	2,562	2,939,000	46.0-50.0
	Gurra, 1983	4,644	1	2	15	76,000	40.0
	Jackson, 1981	4,756	35	46	11,240	14,478,000	40.0-48.0
	Jackson South, 1982	4,830	6	8	665	1,127,000	40.8
	Jena, 1985	5,237	1	1	10	42,000	41.0
	Kerlcummura, 1985			1		1,000	50.8
	Kerrina, 1983	4,800	1	1	7	17,000	41.0
	Limestone Creek Beds, 1984	5,200	13	17	986	1,352,000	41.0
	Mawson, 1987		1	1	44	85,000	
	McKinlay, 1985	5,100	1	1	10	51,000	41.0
	Merani, 1985	5,600	3	3	224	401,000	41.0
	Merrimelia, 1983	5,200-5,700	23	27	2,341	3,454,000	35.5
	Moolampan, 1985	4,900	1	1	65	77,000	40.0
	Moorari, 1971	5,400-5,430	3	3	624	224,568	46.9
	Munro, 1988		1	1	10	40,000	
	Mutonia, 1985	6,000	5	8	1,247	1,967,700	45.0
	Naccowlah East, 1988		1	1	1	1,000	
	Naccowlah South, 1984	5,100	4	10	849	1,305,000	40.0-46.0
	Naccowlah West, 1981	5,700	9	14	1,514	2,044,000	40.0
	Nafari		1	1	2	1,000	
	Narcoonowie, 1983	5,100	1	1	49	184,000	52.0-53.0
	Nungarao, 1985	4,150	1	1	10	50,000	40.0
	Pintan North, 1988		1	1	54	20,000	
	Pinkery, 1988		1	1	18	48,000	
	Sigma, 1983	5,300	3	3	156	113,000	40.0
	Spencer, 1986	4,500	3	8	1,558	1,981,000	47.0
	Strzelecki, 1978	5,447	15	17	1,751	12,443,000	43.0-44.0
	Sturt, 1988		1	1	80	29,000	
	Sturt East		1	1	20	7,000	
	Talaloa, 1988		1	1	444	122,000	
	Tartanna, 1988		1	1	961	414,000	
	Tirrawarra, 1984	5,400	1	1	11	421,000	40.0
	Tirrawarra, 1970	4,500	6	7	1,442	1,444,175	52.0
	Toby, 1967				66	25,000	
	Ulandi, 1985	5,200	1	1	91	46,000	40.4
	Wancoocha, 1984	4,900	4	6	885	1,204,000	41.0-54.0
	Watchi, 1985		1	1	45	167,000	
	Watson South, 1989	5,900	1	1	713	771,000	41.0
	Wilson, 1983	5,000	1	1	90	434,000	40.0
	Workena, 1987	4,774		1	1		41.5
	Yanda, 1984	5,100		1	43	96,000	40.0
WAPET GROUP	Barrow Island, 1964	2,100-9,500	174	184	15,796	230,419,424	37.7
	Dongara, 1969	5,150-5,477	3	8	207	966,274	35.5
WOODSIDE	North Rankin, 1972	4,400	8	14	14,731	17,596,000	52.3
BRIDGE OIL LTD	Beggs Creek, 1980	5,630		1		1,800	46.0
	Louise, 1986	5,910	1	1	68	94,137	58.0
	Narrows, 1986	5,754	1	1	75	16,135	60.0
	Taylor, 1988	5,558	5	6	449	1,157,725	47.0
	Thornby Creek, 1979	5,150	1	1	3	44,400	50.0
	Waggamra, 1978	5,675	1	1	3	13,011	55.0
	Yellow Bank Creek, 1983	5,180	2	3	44	66,584	52.0
COMMAND	Nockatunga ATP267P, 1983	5,310	3	5	165	244,499	48.0
	Kihee, 1986	5,200	1	1	1	813	44.7
	Keera, 1985	4,870				952	41.0
	Wirrie, 1985	5,300	1	1	65	104,036	45.8
	Thurlgo, 1986	5,445	4	4	181	211,370	46.8
	Maxwell, 1987	5,430	2	2	244	114,174	47.2
	Fairymount ATP377P, 1985	6,730	4	5	394	269,155	50.5
	Mindagabie ATP 246, 1987	5,290	1	1	2	668	48.3

WORLDWIDE PRODUCTION

		Name of field, discovery date	Depth, ft	No. of wells: Producing	No. of wells: Total	Production: 1988 average B/d	Production: Cumulative to Dec. 31, 1988 Bbl	°API gravity
	ESSO-BHP[e]	• Barracouta, 1965	4,550	2	2			62.8
		• Marlin, 1966	5,100	1	4			50.0
		• Kingfish, 1967	7,500	26	37			46.9
		• Halibut, 1967	7,700	10	17			43.3
		• Mackerel, 1969	7,700	18	18			45.6
		• Tuna, 1968	6,500	20	22	374,206	2,527,700,130	40.5
		• Snapper, 1968	4,350	16	21			47.0
		• Cobia, 1972	7,700	10	12			44.6
		• West Kingfish, 1968	7,500	15	18			46.9
		• Fortescue, 1978	7,700	23	25			43.0
		• Flounder, 1968	8,200	8	10			46.7
	STRATA OIL[e]	Woodada, 1980	7,400					54.0
	WESTERN MINING CORP.[e]	North Herald, 1982	3,937	1	1			44.0
		South Pepper, 1982	4,036	1				44.0
		Total Australia		951	1,221	516,500	2,926,807,713	
AUSTRIA	RAG (MOBIL SHELL)	Gaiselberg, 1938	5,200	33	67	734	32,395,600	27.0
		Kematen, 1979	6,100	8	9	865	3,991,466	34.0
		Sattledt, 1971	5,700	17	21	557	5,227,062	37.0
		Voitsdorf, 1963	7,000	17	39	507	21,754,560	36.0
		Other		53	130	1,289	26,567,780	32.0
	OEMV[e]	Hochleiten, 1977	3,100- 5,000					21.3
		Matzen, 1949	6,100					25.7
		Pirawarth, 1957	1,600- 6,500	865	1,287	18,400	583,483,854	28.4
		St. Ulrich, 1938	1,600- 4,300					31.1
		Total Austria		987	1,553	22,352	673,410,322	
BAHRAIN	BANOCO	Awali, 1932	1,850- 4,600	267	337	39,595	799,356,000	33.0
		Total Bahrain		267	337	39,595	799,356,000	
BARBADOS	BARB. NOC	Woodbourne, 1966	1,665- 6,701	85	135	1,166	5,017,389	27.2
		Total Barbados		85	135	1,166	5,017,389	
BENIN	ASHLAND	Seme, 1968	6,232	6	6	5,000	13,354,000	
		Total Benin		6	6	5,000	13,354,000	
BOLIVIA	YPFB	Camiri, 1927	3,936	44	53	461	48,455,363	55.0
		Carand, 1960	3,940	30	37	373	54,250,639	60.0
		Colpa, 1961	9,184	15	15	162	18,227,969	65.0
		Espino, 1979	14,655	1	3	4	966,307	56.2
		H. Suarez R., 1982	7,820	1	9	33	486,560	35.0
		La Pena, 1965	8,856	24	30	5,006	26,806,382	43.0
		Monteagudo, 1966	4,592	25	29	1,547	32,097,267	41.0
		Palmar, 1964	10,756	5	6	81	1,716,183	65.0
		Rio Grande, 1961	9,512	37	37	2,180	60,764,321	62.0
		San Roque, 1981	7,170	6	7	813	715,421	71.0
		Santa Cruz, 1986	9,350	8	14	1,210	1,542,071	65.0
		Villamontes, 1987	9,770	3	5	736	425,887	57.0
		Vuelta Grande, 1978	8,220	8	14	1,607	2,380,333	67.0
		Cascabel, 1985	11,319	1	1	297	134,105	45.6
		Naranjillos, 1964	4,806	2	12	116	46,137	63.6
		Sirari, 1985	13,999	2	2	147	55,825	65.3
		Vibora, 1988	12,949	1	2	267	97,862	57.7
		Other		70	70	640	30,988,471	
	OCCIDENTAL	Tita, 1976	6,450	1	15	126	4,378,711	67.9
		Porvenir, 1978	9,600	5	9	2,468	11,233,974	60.5
	TESORO BOLIVIA PETROLEUM CO.	La Vertiente, 1977	15,230	6	7	405	4,396,737	64.1
		Escondido, 1980	11,293		3			60.0
		Taiguati, 1981	10,174		1			63.0
		Los Suris, 1981	13,577		1			50.0
		Total Bolivia		301	382	19,179	300,166,525	
BRAZIL	ALAGOAS	Furado, 1969	4,440- 5,500	54	58	2,380	14,662,000	35.0
		• Mero, 1974	6,500- 7,400				151,000	35.0
		Pilar, 1981	4,100- 5,100	73	78	6,466	12,056,000	40.0
		Tabuleiro de Martins, 1957	3,900- 4,950	29	29	447	3,998,000	27.0
		Other		22	24	683	2,018,000	
	AMAZONAS	Igarape Cuia, 1985	3,600- 3,700				25,000	41.0
		Rio Urucu, 1986	7,500- 8,300	3	5	238	87,000	44.0
	BAHIA	Agua Grande, 1951	820- 4,265	129	132	4,860	275,340,000	40.0
		Aracas, 1965	3,280- 8,856	170	173	6,380	111,508,000	41.0

WORLDWIDE PRODUCTION

		Name of field, discovery date	Depth, ft	No. of wells: Producing	No. of wells: Total	Production: 1988 average B/d	Production: Cumulative to Dec. 31, 1988 Bbl	°API gravity
		Buracica, 1959	1,476- 1,840	222	226	6,208	137,874,000	35.0
		Candeias, 1941	3,280- 7,415	36	36	2,510	78,300,000	30.0
	•	Candeias Mar, 1941	3,300- 7,400	17	17	547	7,089,000	30.0
		Cassarongongo, 1959	1,475- 4,755	128	129	2,815	15,512,000	32.0
		Cexis, 1983	1,670- 5,230	22	23	2,175	3,792,000	30.0
	•	Dom Joao Mar, 1947	920- 3,000	293	296	4,068	82,593,000	38.0
		Dom Joao Terra, 1947	920- 1,350	67	71	931	20,676,000	38.0
		Faz. Alvorada, 1985	2,100- 4,900	85	92	5,457	6,636,000	31.0
		Faz. Balsamo, 1983	2,500- 4,000	141	153	7,340	8,933,000	31.0
		Faz. Boa Esperanca, 1966	7,215- 8,036	26	26	1,117	15,498,000	39.0
		Faz. Imbe, 1964	2,130- 5,575	64	70	1,928	15,390,000	40.0
		Faz. Pareias, 1962	2,400- 5,100	14	15	382	6,554,000	37.0
	•	Ineus, 1979	1,500				895,000	41.0
		Malombe, 1966	5,280	18	21	336	6,969,000	41.0
		Mata Remanso, 1971	4,445- 4,560	75	91	2,010	20,233,000	35.0
		Miranga, 1965	3,280- 3,936	224	232	9,045	190,215,000	40.0
		Riacho da Barra, 1982	2,910- 3,998	54	58	3,353	11,635,000	39.0
		Rio do Bu, 1984	2,900- 3,000	49	50	2,867	2,777,000	33.0
		Rio Dos Ovos, 1979	2,410- 3,740	13	16	329	2,021,000	35.0
		Rio Pojuca, 1982	5,600- 6,200	25	25	2,422	4,537,000	35.0
		Sartana, 1962	2,470- 4,000	6	9	193	5,604,000	37.0
		Sesmaria, 1963	3,100- 4,600	32	39	686	3,097,000	40.0
		Taquipe, 1968	3,115- 3,935	107	408	4,195	65,738,000	40.0
		Other		168	179	3,805	22,300,000	
CEARA	•	Atum, 1983	5,800- 6,750	9	10	3,883	7,950,000	25.0
	•	Curima, 1978	6,888	15	17	4,801	18,796,000	32.0
	•	Espada, 1983	5,750- 6,900	6	6	1,600	3,967,000	26.0
		Faz. Belem, 1980	1,150- 2,500	293	295	3,988	5,456,000	13.0
	•	Xareu, 1977	5,717- 5,766	24	28	2,843	14,516,000	39.0
ESPIRITO SANTO	•	Cacao, 1978	9,184	7	7	3,402	9,734,000	32.0
		Faz. Cedro, 1962	5,248	26	43	1,324	11,427,000	28.0
		Lagoa Parda, 1977	5,576	56	67	3,667	22,668,000	30.0
		Lagoa Piabanha, 1964	6,500	3	7	245	1,654,000	27.0
		Lagoa Suruaca, 1962	6,400	16	22	1,657	5,121,000	30.0
		Rio Itaunas, 1977	5,400	37	42	915	3,660,000	28.0
		Rio Preto Oeste Sul, 1976		36	40	772	2,090,000	
		Sao Mateus, 1969	5,750	68	82	1,458	5,518,000	27.0
		Other		75	78	3,443	3,254,000	
RIO DE JANEIRO	•	Albacora, 1984	8,430	6	19	16,960	6,805,000	26.0
	•	Arequim, 1981	8,200- 8,500	3	3	1,836	3,851,000	27.0
	•	Area RJS-150					296,000	26.0
	•	Area RJS-236 Trinta, 1983	8,800-11,000	2	4	3,432	10,347,000	28.0
	•	Badejo, 1981	8,500-10,500	4	10	4,788	17,442,000	28.0
	•	Bagre, 1983	8,700- 9,000	7	10	5,694	6,579,000	25.0
	•	Bicudo, 1982	8,000-11,000	9	12	12,069	35,613,000	22.0
	•	Bonito, 1977	6,950- 8,000	10	17	9,816	31,826,000	27.0
	•	Cherne, 1982	9,900-10,700	24	24	33,157	52,087,000	27.0
	•	Corvina, 1983	9,000-11,000	6	8	16,767	30,707,000	25.0
	•	Enchova, 1976	6,973- 7,885	1	26	10,980	76,130,000	23.0
	•	Garoupa, 1974	11,382	16	20	29,975	70,077,000	30.0
	•	Garoupinha, 1974	12,693	3	4	3,766	11,798,000	30.0
	•	Linguado, 1981	9,000-11,000	10	15	28,112	63,808,000	20.0
	•	Marimba, 1983	8,400- 9,200	4	6	49,158	12,859,000	28.0
	•	Moreia, 1984	8,200- 9,500	5	6	4,845	3,476,000	22.0
	•	Namorado, 1975	10,083	29	42	58,851	120,452,000	28.0
	•	Pampo, 1977	6,215	23	62	43,126	109,499,000	21.0
	•	Parati, 1982	8,400- 9,200	3	6	1,220	5,154,000	25.0
	•	Pirauna, 1982	8,000-10,500	8	9	15,909	26,770,000	27.0
	•	Sul de Pampo, 1978	9,300- 9,600					20.0
	•	Vidia, 1981	9,200- 9,400	7	8	8,710	11,230,000	26.0
	•	Carapeba		4	4	44	16,000	
	•	Pargo		1	1	3	1,000	
RIO GRANDE DO NORTE	•	Aguiha, 1975	5,412	1	4	1,112	2,333,000	33.0
		Alto do Rodrigues, 1981	990- 1,120	289	403	4,757	7,216,000	18.0
	•	Area 1-RNS-3A, 1982					178,000	32.0
		Canto do Amaro, 1986	2,500- 3,600	263	270	18,163	9,181,000	25.0
		Estreito Rio Panon, 1983	650- 820	431	444	4,931	10,224,000	16.0
		Faz. Pocinho, 1982	1,450- 2,000	186	202	4,196	10,199,000	45.0
		Guamare, 1983	1,400- 1,600	90	96	562	1,642,000	25.0
		Livramento, 1986	2,500- 3,300	29	43	4,044	3,800,000	41.0
		Lorena, 1984	1,200- 1,700	12	20	427	749,000	28.0
	•	Macau Mar, 1986	3,000	5	5	203	447,000	31.0
		Macau Terra, 1982	3,000- 3,300	2	12	72	431,000	31.0
		Paimeiras, 1982	1,450- 1,800					25.0
		Serraria, 1982	3,200- 3,900	37	37	1,634	2,895,000	27.0
	•	Ubarana, 1973	7,216- 8,365	85	89	15,418	52,788,000	40.0
		Upanema, 1985	1,110- 1,800	17	24	973	1,929,000	28.0
		Other		85	98	4,815	2,176,000	
PARA	•	Area 1-PAS-11, 1983					421,000	41.0
MARANHAO		Sao Joao, 1983	4,950- 6,200	5	8		75,000	40.0

WORLDWIDE PRODUCTION

		Name of field, discovery date	Depth, ft	No. of wells: Producing	No. of wells: Total	Production: 1988 average B/d	Production: Cumulative to Dec. 31, 1988 Bbl	°API gravity
	SERGIPE	Atalaia Sul, 1961	1,450	4	7	18	2,686,000	24.0
		Brejo Grande, 1967	1,670	13	13	457	1,933,000	26.0
		• Caioba, 1969	6,232- 6,890	10	12	2,131	30,351,000	36.0
		• Camurim, 1970	6,232	50	52	5,552	17,385,000	25.0
		Carmopolis, 1963	2,460	852	892	24,765	170,413,000	24.0
		• Dourado, 1970	3,620- 3,635	4	5	907	4,286,000	36.0
		• Guaricema, 1968	3,335- 4,430	12	12	3,995	36,484,000	41.0
		Riachuelo, 1961	1,475	240	245	3,693	21,850,000	28.0
		• Robalo, 1973	3,300- 4,500	4	5	27	828,000	30.0
		Siririzinho, 1967	1,640	166	196	5,177	36,297,000	30.0
		Other		88	94	1,528	4,064,000	
		Total Brazil		6,166	6,597	547,219	2,435,450,000	
BRUNEI	SHELL	• Fairley, 1969	10,740	34	62	11,200	111,299,000	42.0
		• S. West Ampa, 1963	7,068- 8,155	114	267	38,520	529,598,000	41.0
		• Maggie, 1975		14	32	18,030	73,499,000	32.0
		Seria Total, 1928		322	770	21,980	981,198,000	31.0
		• Champion, 1970	4,300	93	231	37,980	299,701,000	23.0
		Rasau, 1929		6	15	2,460	5,000,000	40.0
		Total Brunei		583	1,379	129,770	2,000,295,000	
BURMA[e]	MYANMA	Chauk Lanywa, 1902	1,500- 4,000					36.0
		Mann, 1970	1,600- 7,000					37.5
		Myanaung, 1964	2,000- 4,000	450	450	15,000	495,175,000	40.5
		Prome, 1965	850- 5,000					36.0
		Yenangyaung, 1902	100- 6,700					36.0
		Total Burma		450	450	15,000	495,175,000	
CAMEROON[e]	ELF	• Betika, 1972	5,400					42.5
		Ekoundou S, 1975	6,200					24.0
		Kole, 1974	5,500					31.0
		Kombo Center, 1976	6,900					37.0
		Kombo North, 1978	7,200					35.0
		Ekoundou Horst plus Center, 1972	7,200					29.0
		Boa, 1976	5,900					35.0
		Bavo South, 1976	5,600					29.5
		Betika S. Marine, 1979	6,300	175	179	172,000	439,819,900	30.0
		Ekoundou N. Marine, 1977	5,250					36.0
		Mokoko NE plus Abana, 1977	4,600					29.0
		Asoma Marine, 1973	3,600					19.0
		Kita E. Marine, 1978	6,900					40.5
		Mokoko S. Marine, 1977	4,300					27.0
		Inova Marine, 1976	6,200					32.5
	TOTAL CFP	• Moudi, 1979	5,250- 5,900					40.0
		• Moudi D., 1980	3,300					21.5
		Total Cameroon		175	179	172,000	439,819,900	
CANADA	ALBERTA	Acheson, 1950	3,390	99	120	19,564	127,226,625	38.0
		Bantry, 1940	2,674- 3,400	150	202	7,006	49,358,814	
		Bellshill Lake, 1955	2,950	427	560	12,560	63,245,491	
		Bonnie Glen, 1962	3,450- 6,779	142	169	17,750	502,601,208	34.0-44.0
		Carson Creek N., 1958	8,787- 8,945	40	71	9,466	140,412,051	44.0
		Crestford, 1950	2,800- 4,028	175	284	8,450	60,969,579	
		Clive, 1951	6,074- 6,209	147	188	5,629	61,204,764	
		Countess, 1951	2,668- 4,252	120	154	6,023	63,856,655	
		Fenn Big Valley, 1950	5,900- 6,400	139	312	9,686	119,762,910	32.0
		Gilby, 1962	4,293- 7,000	85	194	2,812	30,492,569	
		Golden Spike, 1949	5,570- 5,961	57	84	2,141	181,734,170	38.0
		Grand Forks		404	481	22,994	140,880,719	
		Harmattan East, 1964	6,398- 8,766	100	146	4,378	72,528,643	
		Harmattan Elkton, 1955	8,196-10,763	64	81	4,423	67,063,117	
		Hayter, 1968	2,680- 2,815	276	368	7,696	12,741,106	
		Innisfail, 1956	6,730- 8,440	64	74	4,916	75,196,010	
		Joarcam, 1949	5,174	164	288	9,434	102,248,430	
		Joffre, 1953	4,984- 6,779	80	174	4,761	83,268,775	
		Judy Creek, 1961	8,301- 8,701	188	269	14,727	496,486,344	43.0
		Kaybob, 1957	8,870- 9,577	68	99	6,202	102,532,966	
		Kaybob S., 1958	9,600-10,043	67	101	8,481	79,550,045	
		Leduc Woodbend, 1947	5,092- 5,386	131	240	4,471	376,844,573	40.0
		Lloydminster, 1933	1,490- 1,945	424	690	9,643	49,479,747	
		Medicine River, 1954	5,435- 7,600	254	435	11,864	71,372,450	
		Mitsue, 1964	9,908	270	338	29,606	282,209,483	43.0
		Nipisi, 1965	5,638- 6,726	271	355	31,168	274,984,064	41.0
		Pembina, 1953	3,000- 6,134	3,415	4,180	102,412	1,241,602,803	37.0-47.0
		Provost, 1946	2,760- 2,898	1,198	1,673	26,894	80,231,351	
		Rainbow, 1965	4,994- 6,160	295	356	14,915	514,945,344	38.0-42.0
		Rainbow South, 1965	6,102- 6,400	91	90	6,023	64,268,448	
		Red Earth, 1956	4,184- 4,878	190	287	5,293	37,964,546	

WORLDWIDE PRODUCTION

	Name of field, discovery date	Depth, ft	No. of wells: Producing	No. of wells: Total	Production: 1988 average B/d	Production: Cumulative to Dec. 31, 1988 Bbl	°API gravity
	Redwater, 1948	2,012-3,200	583	862	14,439	789,353,382	35.0
	Simonette, 1958	10,500	33	51	2,305	38,211,164	
	Snipe Lake, 1962	8,500	41	47	1,032	54,049,733	
	Sturgeon Lake S., 1953	4,912-8,471	89	143	15,927	142,839,903	
	Sundre, 1954	8,700-9,000	58	77	3,382	97,029,438	
	Swan Hills, 1957	8,140	596	835	39,378	680,522,132	40.0
	Swan Hills S., 1959	8,410	172	199	16,252	344,427,758	
	Taber N., 1966	3,110-3,270	90	124	5,721	14,839,846	
	Turner Valley, 1913	3,100-9,150	109	158	2,710	149,418,237	39.0
	Utikuma Lake, 1963	5,624	112	126	12,497	47,384,559	
	Valhalla, 1973	5,815-7,660	158	192	7,337	10,790,816	
	Virginia Hills, 1957	9,210	125	180	16,385	147,968,379	44.0
	Wainwright, 1925	3,405-3,700	606	768	4,615	69,094,706	
	Westerose, 1962	6,818	35	42	13,513	130,394,221	
	Westlem		10	13	10,791	39,814,017	
	Whitelaw Grego, 1956	5,157	470	601	8,541	117,184,172	
	Wizard Lake, 1951	4,944-5,475	40	47	11,324	322,526,443	
	Zama, 1968	3,700	139	236	5,964	79,573,948	33.0
	Other		8,328	13,002	41,887	1,480,777,744	
BRITISH COLUMBIA	Boundary Lake, 1951	2,476-4,929	198	358	10,957	172,681,084	41.0
	Eagle West, 1976	2,700-3,450	33	40	6,564	26,427,191	
	Other		354	740	15,234	237,796,322	
MANITOBA	All fields		1,497	1,604	13,224	166,170,610	
SASKATCHEWAN	Steelman, 1950	1,400	661	730	4,166	255,849,424	
	Weyburn, 1955	4,400	595	823	17,585	287,187,137	
	Other		13,460	16,918	184,360	1,214,484,042	
ONTARIO	All fields		1,190	1,545	4,271	62,248,634	
NEW BRUNSWICK	All fields		1	1	6	605,261	
NORTHWEST TERRITORIES	All fields		154	169	63,164	65,671,707	
	Total Canada		38,557	54,577	1,280,778	13,297,548,630	

CHILE

ENAP-MAINLAND	Canadon, 1962	6,890	42	60	649	14,554,966	38.4
	Daniel, 1960	6,808	7	11	131	2,148,240	35.4
	Daniel Este, 1961	5,923	10	44	241	6,417,463	35.0
	Dungeness, 1967	5,282	1	19	167	1,838,542	38.6
	Flamenco, 1960	5,902	47	74	1,111	21,414,450	38.6
	Fell Este, 1967	7,361	5	25	113	2,281,638	35.0
	Delgada Este, 1958	7,694	9	32	147	1,663,444	34.0
	Other		27	228	1,990	14,999,613	
TIERRA DEL FUEGO	Catalina, 1965	6,545	36	62	934	23,815,626	34.2
	Catalina, 1958	6,756	4	29	174	4,161,157	34.1
	Catalina Sur, 1961	6,774	4	43	74	2,168,136	33.1
	Cullen, 1954	6,760	15	30	904	21,298,933	31.8
	Cullen, 1966	6,905	2	10	106	941,114	34.0
	San Sebastian Norte, 1966	6,851	1	1	19	197,554	37.0
	Tres Lagos, 1957	5,938	1	44	518	13,963,314	31.1
	Chanarcillo, 1961	7,304	2	17	94	2,253,634	36.2
	Condor, 1961	7,128	2	23	1	15,217,776	31.2
	Estancia Sur, 1965	7,447	2	14	14	748,743	31.0
	Other		41	51	1,811	31,000,814	
STRAIT OF MAGELLAN	Daniel Este/Dungeness, 1961	6,128	1	30	1,131	4,166,174	35.4
	Isla, 1958	6,830	1	3	108	1,400,001	34.5
	Otway, 1972	7,196	2	18	615	4,019,060	33.1
	Pecten, 1964	7,251	11	11	1,143	4,164,581	33.1
	Phoenix, 1971	6,772	2	14	190	1,196,527	33.5
	Spitfire, 1971	6,744	21	47	3,405	47,311,781	33.5
	Spitfire Norte, 1975	6,750	12	19	2,755	14,146,302	34.1
	Otway, 1958	7,197	2	2	1,213	11,175,843	33.1
	Total Chile		370	1,514	24,397	361,384,456	

CHINA[c]

WESTERN REGION: JUNGGAR BASIN, TARIM BASIN, TURPEN BASIN	Karamay, 1955						
	Dushanzi, 1941						
	Other						
CENTRAL REGION: JIUQUAN BASIN	Yumen, 1939						
CENTRAL REGION: SICHUAN BASIN	All fields						
CENTRAL REGION: SHAN GAN NING BASIN	Chang Qing, 1970						
	Yanchang, 1907						
CENTRAL REGION: QAIDAM BASIN	Qingtai, 1955						
	Lenghu, 5 & 6, 1958						
	Other						
EASTERN REGION: SONGLIAO BASIN	Daqing, 1959		11,000	NA	1,100,000	11,000,000,000	
	Fuyu, 1958						
	Jilin, 1975						
EASTERN REGION: BOHAI BASIN	Shengli, 1961						
	Renqiu, 1975						

WORLDWIDE PRODUCTION

		Name of field, discovery date	Depth, ft	No. of wells: Producing	No. of wells: Total	Production: 1988 average B/d	Production: Cumulative to Dec. 31, 1988 Bbl	API gravity
		Liaohe, 1964						
		Dagang, 1964						
		Zhongyuan, 1981						
		Hu, 1970						
	EASTERN REGION: JIANGHAN BASIN	Qianjiang, 1966						
		Other						
	EASTERN REGION: NANXIANG BASIN	Nanxiang, 1971						
	EASTERN REGION: SUBEI BASIN	All fields						
		Total China		43,700	NA	2,733,000	13,695,791,000	
CHINA, TAIWAN	CHINESE PETROLEUM	• Cbk, 1986		4	4	837		47.0
		Chingtsohu, 1967		7	14	82		50.0
		Chuhsiangkeng, 1960		28	29	224	22,715,347	50.0
		Tiechengshan, 1969		31	41	1,027		51.0
		Yunghoshan, 1971		23	44	288		45.0
		Total China, Taiwan		83	116	2,458	22,715,347	
COLOMBIA	ECOPETROL[e]	Galan, 1945	3,200	62	71			14.0
		Infantas, 1918	3,200	263	307			25.8
		La Cira, 1925	3,250	612	765			34.0
		La Nutria, 1967	9,500	130	137			35.0
		Llanito, 1960	7,400	60	62			23.0
		Cartagena, 1941	6,800	11	13			19.1
		Casabe, 1941	3,800	410	416			26.1
		Yarigui, 1954	8,700	88	94			34.0
		Boquete, 1961	8,000	12	20			43.0
		Cayuco, 1956		5	22			
		Petrolea, 1933		6	21			
		Tibu, 1940		189	261			
		Ortega, 1951		5	6			18.0
		Apiay, 1981	10,500	3	22			24.0
		Orito, 1963	6,600	58	75			26.0
		Other		129	215			
	ARGOSY[e]	Bouzigue, 1974	11,000	2	4			15.0
		Maxine, 1976	11,000	1	1			15.0
		Nancy, 1974	11,000	1	1			15.0
	HOCOL SA (SHELL)[e]	Palagiarde, 1971	6,500	32	46	141,447	2,139,697,264	25.0
		Rubi, 1981	7,000	6	6			23.0
		San Francisco, 1985	2,800	41	41			23.0
		Hato Nuevo, 1983	6,400	3	4			35.0
		Teruel, 1985	11,500	3	5			16.0
		Santa Clara, 1987	5,200	5	6			17.0
		La Jagua, 1986	5,400	3	5			25.0
		Llama Larga, 1985	3,500	1	1			32.4
		Brisas, 1983	4,200	4	6			21.0
		Dina T, 1961	3,400	52	64			26.0
		Dina K, 1969	6,500	33	36			23.0
		La Canada, 1966	700	5	7			21.0
		Teca, 1972	1,800	40	54			23.0
		Leba, 1981	6,500	8	11			19.0
	ESSO COLOMBIANA LTD	Arauca, 1980	8,000	5	43	3,170	8,365,838	41.0
		Bonanza, 1963	4,000	33	37	2,777	43,951,505	36.0
		Provincia, 1962	8,000	130	179	14,699	260,526,411	33.0
	ELF AQUITAINE	Barquereña, 1982	4,500	5	5	1,186	823,344	32.3
		Cano Garza, 1979	1,800	3	3	791	1,291,847	40.2
		Cano Garza Norte, 1983	1,800	2	2	544	665,114	41.0
		Otavo Este, 1987	12,470	1	1		3,482	42.0
		Otavo Sur, 1982	10,600	2	2	1,186	2,395,389	40.2
		Upina Norte, 1983	12,100	1	1	856	861,823	37.2
		Tocana, 1980	13,500	1	1	84	110,611	35.1
		Trinidad, 1974	9,000	3	5	1,993	3,700,997	39.4
	OCCIDENTAL	Cano Limon, 1983	7,800	43	50	100,063	161,197,520	29.0
		Cano Yaromal, 1987	7,600	1	1	429	196,941	29.0
		La Salina, 1936	2,500	48	71	552	13,360,544	35.0
		Mapia, 1962	8,000	17	24	971	19,874,430	27.0
		Redondo, 1984	7,600	3	4	2,996	3,925,822	40.2
	TEXACO	Locarna, 1963	2,100	47	54	1,013	13,909,437	12.0
		Tisquirama, 1963	8,000	6	6	4,018	4,825,054	16.0
		Velasquez, 1946	7,500	108	144	4,664	166,048,429	19.0
	TEXACO ECOPETROL	Los Angeles, 1983	6,400	3	5	522	541,965	14.0
		Nare, 1981	2,100	2	2	111	237,871	11.0
		Teca, 1981	2,100	176	186	14,003	24,774,825	12.0
	CHEVRON	Castilla, 1969	6,500	16	17	13,295	24,861,443	19.5
		Chichimene, 1969	8,400	1	1	366	600,291	21.5
	LASMO	Santiago, 1985	9,600	2	2	1,482	1,760,143	29.0
		Total Colombia		2,785	3,486	379,975	2,824,717,262	

WORLDWIDE PRODUCTION

		Name of field, discovery date	Depth, ft	No. of wells: Producing	No. of wells: Total	Production: 1988 average B/d	Production: Cumulative to Dec. 31, 1988 Bbl	°API gravity
CONGO	AGIP	• Loango, 1972	3,000	52	62	8,559	84,624,090	26.8
		Zatchi	1,980	8	8	2,700	283,464	25.9
	ELF CONGO	• Emeraude, 1969	820	87	97	27,800	168,000,000	21.8
		Kunji, 1980	4,000	2	2	110	540,000	35.8
		• Likouala, 1979	4,270	28	42	17,100	57,200,000	33.1
		Mengo, 1979	6,500	3	3	150	690,000	34.0
		Pointe Indienne, 1951	5,000	3	3	155	7,060,000	36.9
		• Sendji, 1973	3,940	50	75	31,100	55,000,000	30.1
		• Tchibouela, 1983	2,110	28	30	33,600	9,700,000	28.0
		• Yanga, 1979	2,950	49	65	19,400	69,000,000	29.4
		Total Congo		310	387	134,674	452,097,554	
DENMARK	DUC	• Dan, 1971	6,000–6,400			25,748	48,008,127	30.7
		• Gorm, 1971	6,500–7,000			23,283	75,565,367	34.7
		• Rolf, 1981				6,804	9,426,050	37.7
		• Skjold, 1977	5,000			23,552	35,123,505	29.6
		• Tyra, 1986				16,388	17,508,725	56.6
		Total Denmark		—	—	95,775	185,632,374	
DUBAI[e]	DUPETCO	• Fateh, 1966	7,900–9,000					31.8
		• S.W. Fateh, 1970	7,500–9,000					30.3
		• Falah, 1972	8,000	141	156	355,100	2,052,741,600	25.5
		• Rashid, 1973	9,400–11,500					38.0
	ARCO	Margham, 1981	11,200	9	14			43.5
		Total Dubai		150	170	355,100	2,052,741,600	
ECUADOR	TEXACO-CEPE	Aguarico, 1968	9,850	5	10	5,008	44,185,837	27.2
		Atacapi, 1968	9,855	4	6	1,621	12,160,543	31.0
		Auca, 1970	10,576	23	25	16,866	71,041,688	28.0
		Auca Sur, 1980	9,100–10,400	2	2	745	1,410,759	25.6
		Conoraco, 1972	11,233	11	11	14,564	26,070,228	33.3
		Culebra, 1973	10,626	2	2	1,261	2,170,021	17.5
		Dureno, 1968	10,290	1	1	721	930,152	31.0
		Guanta, 1968	9,575	4	4	8,059	4,805,464	24.7
		Lago Agrio, 1967	10,179	20	38	10,196	110,606,831	28.5
		Parahuacu, 1968	10,173	4	5	876	6,357,163	30.0
		Rumiyacu, 1982	10,191		1		2,545,844	21.0
		Sacha, 1969	10,160	41	113	66,831	362,314,028	28.0
		Shushufindi, 1959	9,772	52	80	106,144	533,214,866	30.0
		Yuca, 1970	10,423	5	10	3,224	11,473,294	28.0
		Yuca Sur, 1979	9,600–10,000	1	1	640	1,114,809	14.9
		Yulebra, 1980	8,800–10,000	3	3	2,069	2,950,663	24.3
	CLYDE PETROLEUM	Fanny, 1972	7,700	8	8	6,382	11,140,095	22.5
		Mariann, 1971	7,700	4	5	1,158	3,920,460	20.0
		Tarapoa, 1973	8,800	1	2	325	1,029,262	20.0
	CEPE-ORIENTE[e]	Shushufindi, 1980	9,200	6	6			28.8
		Shuara, 1980	9,100	8	8			29.6
		Secoya, 1980	9,100	15	15			30.3
		Charapa, 1967	10,000	12	12	60,317	199,709,257	30.0
		Cuyabeno, 1972	8,050	4	4			28.8
		Sansahuari, 1979	8,100	1	1			28.8
		Tetete, 1980	9,300	5	5			28.0
		Bermejo, 1967	5,000	9	9			34.0
	CEPE-PENINSULA[e]	Ancon, 1921	4,000	475	475			35.6
		Carpet		70	70			
		Cautivo		100	100			
		Total Ecuador		952	1,037	305,000	1,409,151,259	
EGYPT	GUPCO AMOCO	Abu Gharadig, 1972	9,500	17	27	12,973	54,620,000	35.0-55.0
		• Badri (315), 1981	6,400	21	31	48,988	56,955,000	27.0-28.0
		• El Morgan, 1965	5,100–6,400	113	131	109,852	1,048,950,000	27.0-32.0
		• GH (376), 1981	8,200–9,750	1	5	745	6,047,000	24.0-28.0
		• GS (277), 1980	8,610	1	1	1,712	2,851,000	34.0
		• GS (345,346), 1982	7,500	1	1	1,174	1,189,000	36.0-38.0
		• GS (365), 1980	10,140	1	1	500	965,000	42.0
		• GS (381), 1985	8,700		1		924,000	37.0
		• GS 327, 1983	9,600	1	1	193	2,076,000	20.0
		• Hilal (404), 1982	9,200–10,000	7	9	26,514	46,408,000	32.0
		• July, 1973	8,100–10,000	34	45	57,493	472,067,000	33.0
		NAG 9-9-1, 1985	10,000	1	2	862	1,301,000	35.0
		NEAG 9-15, 1984	10,635–12,126	1	1	495	840,000	35.0
		• Nessim (336), 1981	6,700	1	3	491	8,867,000	29.0
		• October, 1978	11,000	23	32	121,144	443,435,000	27.0-31.0
		• Ramadan, 1974	11,400	24	28	46,710	479,152,000	30.5
		Razzak and E. Razzak, 1972	5,730–7,710	12	19	3,402	52,141,000	38.0

WORLDWIDE PRODUCTION

	Name of field, discovery date	Depth, ft	No. of wells: Producing	No. of wells: Total	Production: 1988 average B/d	Production: Cumulative to Dec. 31, 1988 Bbl	API gravity
	• [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

WORLDWIDE PRODUCTION

		Name of field, discovery date	Depth, ft	No. of wells: Producing	No. of wells: Total	Production: 1988 average B/d	Production: Cumulative to Dec. 31, 1988 Bbl	API gravity
		St. Firmin, 1960	1,800	33	62	458	9,967,266	27.5
		St. Germain, 1984	7,200	9	15	1,377	1,937,207	36.0
		St. Martin, 1959	4,590	9	17	299	8,460,522	33.0
		Vert-le-Grand, 1986	6,230	5	6	2,052	1,246,080	34.8
		Villeperdue, 1959	6,100	95	136	14,601	16,778,600	34.4
		Fontaine-au-Bron, 1986	6,140	8	8	1,185	534,606	35.4
		Champotran, 1985	8,400	7	13	920	561,351	31.1
		Other		72	216	3,458	13,089,240	
		All fields abandoned					14,030,310	
	SOUTHEAST + JURA	All fields abandoned					223,063	
		Total France		608	1,144	67,621	515,426,416	
GABON	ELF[e]	• Anguille, 1962	9,200					31.2
		• Anguille W, 1968	7,500					32.0
		• Anguille SE, 1962	8,200					33.0
		• Ayol Marine, 1979	7,700					22.8
		• Baliste, 1974	4,900					28.3
		• Barbier, 1972	6,000					29.5
		• Batanga, 1960	5,900					39.2
		• Baudroie Marine, 1968	7,500					29.7
		• Baudroie N., 1980	7,500					31.5
		• Breme, 1976	5,000					37.0
		• Clairette, 1966	4,400					32.5
		• Doree, 1972	7,300					30.4
		• Girelle, 1973	9,400					25.7
		• Gonelle, 1972	5,800	218	305	107,345	946,128,270	25.7
		• Grand Anguille, 1983	8,400					31.1
		• Grondin, 1971	7,500					26.6
		• Konzi, 1962	3,600					39.0
		• M'Bya Sud, 1969	6,700					36.2
		• Mandaros, 1972	4,900					20.5
		• Merpi/Sardomg, 1091	9,999					30.2
		Oiende, 1976	6,700					34.0
		• Pageau, 1972	11,500					19.8
		• P.G.S. Marine, 1975	7,500					31.2
		Tchengue, 1957	4,100					31.0
		• Tchengue-Ocean, 1962	6,600					30.2
		• Torpille, 1968	8,200					34.0
		• Torpille NE, 1968	8,200					32.3
	SHELL GABON	Gamba Ivinga, 1963	3,000- 3,100	51	84	11,750	258,701,000	31.6
		Lucina Marine, 1971	5,900	15	22	7,920	51,199,000	38.4
		Lucina Marine W., 1982				820	1,900,000	38.4
		Lucina Marine SE, 1971				2,200	805,000	37.0
	AMOCO	Oguendjo B and C, 1981	5,000- 6,000	19	19	16,601	43,300,000	36.0
	BRITISH GAS	• Obando, 1984	8,650	2	2	2,206	805,000	32.0
		• Octopus, 1984	10,300	3	3	2,532	924,000	33.0
		• Pelican, 1985	9,300	4	4	8,967	3,273,000	31.0
		Total Gabon		312	439	160,341	1,297,035,270	
GHANA	AGRI-PETCO	• Saltpond, 1977	8,500		3		3,938,000	36.0-39.0
		Total Ghana			3		3,938,000	
GREECE	N. AEGEAN PET. CORP.	• Prinos, 1974	8,000- 8,800	11	14	22,457	63,700,000	28.5
		Total Greece		11	14	22,457	63,700,000	
GUATEMALA	MEM*	Caribe, 1981	6,830	3	3	1,274	2,650,639	22.0-24.0
		Rubelsanto, 1974	5,300	7	8	1,234	5,796,391	26.0-30.0
		San Diego, 1981	17,150		1	63	135,865	34.7
		Tierra Blanca	11,230				176,113	19.5
		Tortugas, 1973	2,300				67,800	35.0
		West Chinaja, 1977	3,200- 3,800	3	3	903	7,125,411	35.0-43.0
		Xan, 1985	8,427	1	1	254	128,782	17.5
*Ministerio de Energia y Minas		**Total Guatemala**		14	16	3,728	16,081,001	
INDIA	GUJARAT STATE	Ankleshwar, 1960	1,969- 6,564	138	225	20,963	442,939,000	45.0
		Gandhar, 1984	9,846-12,145	30	43	9,023	3,831,000	47.0
		Kadi, N., 1967	3,610- 7,220	160	200	14,743	6,630,000	21.0
		Kadi, S., 1968	6,892- 9,846	6	11	494	3,578,000	24.0
		Kalol, 1961	4,595-10,830	152	195	8,601	42,190,000	38.0
		Nawagam, 1963	4,595-10,174	74	109	2,668	25,835,000	31.0
		Sanand, 1962	4,267-10,174	22	34	2,670	9,552,000	26.0
		Sobhasan, 1968	4,595- 9,846	59	104	9,349	21,167,000	26.0-40.0
		Viraj, 1978	4,595- 4,923	20	35	2,655	3,797,000	20.0

WORLDWIDE PRODUCTION

	Name of field, discovery date	Depth, ft	No. of wells: Producing	No. of wells: Total	Production: 1988 average B/d	Production: Cumulative to Dec. 31, 1988 Bbl	°API gravity
ASSAM STATE	Golek, 1968	9,518-14,769	70	101	9,856	27,241,000	30.0
	Lakwa-Lakhmani, 1964	6,564-14,113	191	233	39,632	140,811,000	33.0
	Rudrasagar, 1960	7,877-13,128	53	59	10,612	33,806,000	25.0
WEST COAST	B-38 (Heera), 1977	4,267- 6,564	35	35	32,025	45,854,000	37.0
•	Bombay High, 1974	3,282- 7,877	254	254	408,569	1,102,525,000	39.0
	Panna (North Bassein), 1976	4,923- 7,549	7	7	1,198	604,000	38.0
NAGALAND	Changpang, 1973	8,861-10,502	7	11	2,824	3,761,000	34.0
TAMIL NADU	Narimanam, 1985	6,236- 7,549	5	11	560	229,000	29.0-45.0
OTHER FIELDS	Bakrol, 1966	2,626- 9,846		3		37,000	
	Digboi, 1980	300- 7,500	239	696	548	74,250	
	Kathana, 1965	5,250- 5,906	13	22	540	4,903,000	25.0
	Kholka, 1966	5,579- 7,877	12	5	81	584,000	
	Kosamba, 1963	1,313- 8,533	6	9	454	834,000	
	Moran, 1958	11,000	62	89	8,150	93,900	
	Nakhorkatiya, 1953	9,500	134	269	15,573	303,880	
	Wavel, 1967	4,595- 7,220				168,000	
	Jorajan, 1967	7,000-11,500	117	176	16,645	39,500	25.0-34.0
	Total India		1,866	2,936	618,432	1,921,387,530	
INDONESIA PERTAMINA UEP I[e]	Besitang, 1977	3,973					51.5
	Gebang, 1977	2,917					54.0
	K. Simpang, 1971	3,740- 5,019					45.0
	P. Tabuhan, 1937	3,350- 5,893	204	226			50.8
	Rantau, 1929	2,764					45.3
	Serang Jaya, 1926	3,701					47.5
PERTAMINA UEP II[e]	Benuang, 1942	6,103					35.1
	Benakat East, 1973	NA					NA
	Tempino, 1931	1,647					23.0
	Gn. Kemala, 1938	5,448					38.0
	Limau, 1928	3,896- 4,626					NA
	Ogan Timur, 1943	3,793-					27.42
	Talang Jimar, 1937	4,123	412	1,419			31.0
	T. Mering, 1935	640					NA
	Tanjung Tiga, 1938	3,750					28.0
	Kenali Asam, 1931	2,077					29.0
	Beimbing	5,371					
	Kuang, 1940	5,249					25.1
PERTAMINA UEP III[e]	Cemara, 1976	3,964- 7,104					
	Jatibarang, 1969	3,063	88	184			29.0
	Tugu Barat, 1979	3,014					
PERTAMINA UEP IV[e]	Buryu, 1923	2,077					33.2
	Sangatta, 1939	1,842					33.0
	Tanjung, 1938	2,296	161	434	134,454	2,952,389,683	39.9
	Tapian Timur, 1967	4,396					38.8
	Warukin S., 1966	2,067					26.9
PERTAMINA UEP V[e]	Klamono, 1936	574					19.0
	Linda, 1977	4,281	47	55			19.0
	Sele, 1951	2,156					35.0
PERTAMINA (FROM STANVAC)[e]	Sago, 1940	1,800					34.0
	Lirik, 1939	1,600					34.0
	Molek, 1956	2,600					34.0
	N. Pulai, 1941	1,800					34.0
	S. Pulai, 1941	1,800	354	354			34.0
	Talang Akar, 1922	2,800					35.0
	Benakat, 1932	1,600					35.0
	Jirak, 1930	2,300					35.0
	Rajak, 1940	6,000					38.0
	Abab, 1951	6,000					36.0
PERTAMINA (N.E. KALIMANTAN)[e]	Sembakung, 1976	2,600	17	19			36.0
	Bangkudulis, 1980	3,250		1			39.5
PERTAMINA (FROM PHILLIPS)[e]	Salawati, 1976	5,749	7	13			39.2
LEMIGAS[e]	All fields, 1893-1909	2,155- 2,297	71	419			
TOTAL CFP[e]	• Tambora, 1980	8,000-13,000	15	34			33.0
	• Handil, 1974	2,900- 9,000	219	272			33.0
	• Bekapai, 1972	4,600- 5,600	42	45			40.0
ARCO	Ardjuna, 1969	2,380- 7,250	270	317	121,975	683,283,000	37.0
	Arimbi, 1972	2,943	20	30	10,248	26,331,000	33.0
	NWC, 1974	5,411-5,800	14	15	6,027	5,053,000	31.5
	Bima, 1983	3,000- 3,888	35	50	13,990	1,536,000	34.0
AGL PETROLEUM (SERAM) LTD.	Bula, 1897	280- 1,400	123	63	1,252	15,090,196	23.0
CHEVRON & TEXACO	Batang, 1975	690	12	13	593		19.0
	Buaya, 1978	2,035		2			28.0
	Lindai, 1971	1,100	18	20	1,581		32.0
	Menggala S., 1968	3,765	2	3	906		34.0

WORLDWIDE PRODUCTION

	Name of field, discovery date	Depth, ft	No. of wells: Producing	No. of wells: Total	Production: 1988 average B/d	Production: Cumulative to Dec. 31, 1988 Bbl	°API gravity
	Tanjung Medan, 1976	2,770	2	2	657		34.0
	Benua, 1978	2,400	19	22	5,247		37.0
	Beruk, 1974	1,750	19	25	8,693		38.0
	Beruk NE, 1976	1,800	3	5	281		40.0
	Beruk North, 1986	1,900	4	5	1,063		38.0
	Bungsu, 1976	2,050	7	8	1,252		38.0
	Damar, 1974	4,650	5	6	597		34.0
	Dusun, 1979	2,560	6	7	1,779		42.0
	Gatam, 1977	2,385	1	3			34.0
	Idris, 1982	2,450	1	3	564		39.0
	Kaskikan, 1972	660	19	27	936		18.0
	Osam, 1978	900	5	6	336		32.0
	Paitan, 1978	2,415	1	3	291		32.0
	Pedada, 1973	950	23	31	10,854		33.0
	Pusaka, 1977	2,250	20	23	6,532		36.0
	Sabak, 1974	1,350	14	15	5,264		36.0
	Terantam, 1973	900	4	4	139		32.0
	Zamrud, 1975	3,600	53	54	19,804		40.0
	Langgak, 1976	1,380	20	24	1,610		32.0
CALTEX PACIFIC INDONESIA	Central Sumatra Area, 1974	4,700	16	17	4,568		34.0
	Ampuh, 1981	6,000	12	12	3,357		38.0
	Antara, 1978	1,425	5	9	833		36.0
	Balam SE, 1972	4,500	13	19	706		34.0
	Balam South, 1969	1,600	53	54	8,701		33.0
	Bangko, 1970	1,900	76	90	31,436		34.0
	Batang CPI, 1975	600	6	7	413		18.0
	Bekasap, 1955	2,350	56	63	19,845		
	Bekasap South, 1968	3,900	9	14	1,165		44.0
	Benar, 1973	2,150	26	30	5,263		33.0
	Cerikan, 1974	4,700	4	5	745		40.0
	Duyung, 1981	5,800	1	1	141		43.0
	Duri, 1941	770	1,237	1,305	49,951		20.0
	Ganas, 1980	3,600	1	1			31.0
	Hitam, 1975	6,600	3	5	1,263		39.0
	Hiu, 1983	5,900	3	3	974		34.0
	Intan, 1977	3,450	6	7	1,626		41.0
	Jurang, 1972	5,400	17	19	14,470		34.0
	Ketang, 1977	3,900	11	13	1,431		34.0
	Kopar, 1974	5,400	13	19	3,830		37.0
	Kotabatak, 1952	5,900	55	114	7,943		24.0
	Kulin, 1970	2,050	55	69	6,490		38.0
	Libo, 1968	6,000	5	17	4,612	6,611,000	39.0
	Libo SE, 1973	5,900	10	13	1,311		42.0
	Limau, 1981	2,670	4	4	459		39.0
	Menggala N, 1968	3,850	15	20	3,134		34.0
	Menggala S CPI, 1968	3,765	6	7	1,218		41.0
	Minas, 1944	2,600	365	613	169,067		35.0
	Mindal, 1971	3,400	2	4	87		37.0
	Mutiara, 1976	3,500	2	3	87		41.0
	Nella, 1977	5,000	1	1	19		18.0
	Obor, 1978	7,470	1	1	122		41.0
	Pager, 1974	4,300	24	41	6,136		34.0
	Pelita, 1977	6,600	5	6	1,364		44.0
	Pematang, 1959	3,750	47	64	8,737		32.0
	Pematang Bow, 1969	5,300	9	17	1,570		44.0
	Pemburu, 1981	2,400	9	10	2,441		35.0
	Perkebunan, 1977	2,300	1	1			24.0
	Petani, 1964	3,750	41	44	12,364		34.0
	Petapahan, 1971	4,500	53	60	6,342		34.0
	Pinang, 1971	3,960	19	20	3,908		37.0
	Pinggir, 1972	3,400	3	3	731		39.0
	Pinggir South, 1973	3,300	2	4	11		44.0
	Pudu, 1972	5,960	8	13	1,248		35.0
	Pukat, 1983	6,200	2	2	753		41.0
	Puncak, 1979	2,400	14	16	4,064		36.0
	Pungut, 1951	3,400	27	33	5,146		38.0
	Rangau, 1968	6,100	3	11	108		42.0
	Rantaubais, 1972	3,075	14	18	835		38.0
	Rokan, 1979	6,100		1			41.0
	Serum, 1972	3,000	23	24	6,194		35.0
	Sikladi, 1978	4,340	19	21	1,215		40.0
	Singa, 1977	5,000	1	1	33		41.0
	Sintong, 1971	3,400	23	23	1,610		32.0
	Sintong SE, 1973	4,500	1	1			36.0
	Suram, 1971	1,750	4	7	92		28.0
	Tandun, 1969	3,000	12	15	1,257		44.0
	Telinga, 1975	4,205	1	10	769		34.0
	Topaz, 1977	5,200	1	4	1,000		43.0
	Topi, 1979	3,630	1	1	39		18.0
	Tunas, 1983	4,814	2	3	275		45.0
	Ubi, 1976	4,350	24	28	1,750		45.0
	Waduk, 1982	6,200	4	11	873		38.0

WORLDWIDE PRODUCTION

	Name of field, discovery date	Depth, ft	No. of wells: Producing	No. of wells: Total	Production: 1988 average B/d	Production: Cumulative to Dec. 31, 1988 Bbl	°API gravity
ASAMERA (NORTH SUMATRA)	Aru Dison, 1972	3,098		24			50.8
	Gendondong, 1965	3,192		23			53.1
	Ir Tabeu, 1971	2,721	2	47	16	11,897,472	50.3
	Julu Rayeu, 1968	2,832	6	47	120	12,327,979	53.6
	Peudawa, 1980	3,083		10			48.1
	Tualang, 1973	2,631	5	59	1,052	29,985,653	49.9
ASAMERA (SOUTH SUMATRA)	Bentayan, 1932	4,434	7	8	1,186	1,107,443,220	
	Kluang, 1933	2,591	16	79	447	33,853,017	42.6
	Mangunjaya, 1934	2,700	3	97	80	23,010,846	32.0
	Palembang, 1926	3,415	3	8	29	189,540	33.4
	Rambutan, 1980	3,150	58	63	24,203	44,790,645	37.0
	Rawa, 1985	4,038	24	30	4,403	1,696,174	38.7
	Tanjung Lalang, 1982	3,590	14	27	4,600	6,258,109	38.1
	Tempino, 1931	4,843	4	6	197	1,331,130	40.9
	Ker, 1985	3,957	2	2	103	30,625	41.5
	Sugih, 1984	4,629	3	3	54	68,762,336	33.6
	South Rawa, 1985	4,086	1	1	39	19,886	37.0
MAXUS ENERGY •	Dita, 1970	5,500	40	48	13,068	175,971,048	34.0
•	Duma, 1983	7,300	3	6	110	648,312	24.0
•	Kanda, 1982	8,000	14	26	3,872	11,632,953	32.0
•	Gata, 1972	5,000	6	9	702	7,504,813	34.5
•	Kamia, 1983	4,800	7	9	10,635	29,728,296	36.0
•	Kitty, 1979	2,700	7	7	978	13,973,095	18.0
•	Krisna, 1979	4,500	31	41	6,847	59,655,016	37.0
•	Nora, 1979	4,200	4	5	883	8,807,389	29.0
•	Rama, 1974	3,200	48	75	7,046	91,166,520	31.0
•	Serutar, 1971	4,300	9	13	1,588	20,797,606	19.0
•	Sudan, 1980	4,400	13	35	2,955	10,782,195	25.0
•	Tia, 1982	8,000+		4		1,654,541	33.0
	Wanda, 1984	4,800	1	5	99	1,565,811	36.0
•	Yvonne, 1980	4,500	9	11	3,561	12,621,026	36.0
•	Zella, 1971	7,500	26	44	5,142	36,647,449	33.0
PETROMER TREND	Carmopanaytl, 1979	3,900	18	23	1,636	12,293,954	27.8
	Geo, 1973	4,040	10	19	1,194	28,802,223	42.0
	Kaun, 1972	3,850	34	53	4,021	47,242,196	38.0
	Mata, 1978	2,750	137	403	14,578	150,075,128	34.2
	Other		9	22	1,202	12,370,843	
STANVAC (CENTRAL SUMATRA)	Bekr, 1972	1,600	20	21	891	11,820,840	34.0
	E. Kasuri, 1983	3,500	44	49	4,964	7,050,207	35.0
	Gemuruh, 1983	2,800	18	19	1,298	2,387,366	24.0
	Kasuri, 1961	3,500	9	10	407	2,027,305	35.0
	Kelamantan, 1985	3,000	23	24	1,122	5,121,074	35.0
	Melibur, 1979	2,700	26	26	1,196	6,770,924	36.0
	Mutiara, 1985	2,700	2	2	34	115,064	34.0
	N. Meriau, 1985	2,400	8	8	234	2,835,300	36.0
	Pandak, 1982	2,500	6	6	646	1,527,653	36.0
	Pekan, 1976	3,700	20	22	631	7,803,638	35.0
	Other	4,600				9,175	
STANVAC (SOUTH SUMATRA)	Air, 1970	5,700	12	14	663	21,909,033	36.0
	Jene, 1985	6,500	18	21	1,742	12,769,493	25.0
•	Kerang PSC, 1984	3,400	3	3	2,406	748,377	35.0
	Lagan, 1986	2,400	3	4	255	204,995	36.8
	Pur, 1986	6,000	2	3	102	63,735	36.0
	Rambutan, 1972	4,600	4	5	33	4,222,896	42.0
•	Tabuan PSC	4,000	8	9	1,000	1,644,061	34.0
	Rimbatan PSC, 1984	4,200	2	2	75	27,376	34.0
	Other	4,500	6	6	1,210	1,998,843	
ROY M. HUFFINGTON INC	Batak, 1972	5,140-10,600	104	127	4,137	99,600,000	21.0
	Mutiara, 1984	900-5,800	4	5	1,668	3,936,512	50.0
	Nilam, 1974	4,500-11,600	70	95	4,412	20,447,122	32.0
	Pamagaran, 1974	900-5,200	12	32	1,829	8,600,202	30.0
	Sembelan, 1974	7,900-10,100		37		7,054	35.0
UNOCAL •	Attaka, 1970	7,500	76	97	51,146	451,865,821	34.0
•	Kerindangan, 1972	7,000		8		5,038,615	23.8
•	Melahin, 1972	7,500	4	6	811	6,599,220	23.1
•	Nilam, 1981	9,600	4	4	2,169	4,388,181	33.8
•	Serang, 1973	11,150	14	18	5,817	43,703,643	34.0
•	Yakin, 1976	5,100	23	28	7,944	20,484,023	18.8
CONOCO GROUP •	Kepting, 1982	6,000	2	2	2,868	2,261,590	37.0
•	Udang, 1974	6,500	17	17	6,115	56,492,798	40.0
MOBIL OIL	Arun, 1971	10,000	41	60	115,827	1,149,830,117	55.0
MARATHON •	Kakap Kil, 1985	8,500	4	12	10,000	13,026,000	45.0
HUDBAY (MALACCA STRAIT) •	Kutau, 1990	4,500-9,000	11	17	9,084	3,424,729	47.4
•	Lalang, 1980	3,100-3,600	11	18	8,626	33,706,714	34.6
•	Meldur, 1984	900-1,300	12	19	7,604	5,987,814	45.6
•	Mengkapan, 1981	3,650-4,450	10	10	17,743	13,955,967	42.0
TESORO INDONESIA PETROLEUM	Sambora, 1909	360-4,480	27	125	4,53	64,54[illegible],149	21.0

WORLDWIDE PRODUCTION

		Name of field, discovery date	Depth, ft	No. of wells: Producing	No. of wells: Total	Production: 1988 average B/d	Production: Cumulative to Dec. 31, 1988 Bbl	°API gravity
		Sanga Sanga, 1897	85–6,000	110	242	2,910	267,623,502	33.0
		Tarakan, 1906	200–6,840	135	1,166	1,840	210,824,500	20.0
	TARAKAN PETROLEUM	Tarakan (Mamburungan field), 1984	5,020–5,131	2	4			31.1
		Total Indonesia		6,470	11,232	1,308,000	12,808,790,000	
IRAN[e]	NIOC	Agha Jari, 1936	7,440	58	89			34.0
		Ahwaz Asmari, 1958	8,150	73	85			32.0
		Ahwaz Bangestan, 1958	12,000		7			34.3
		Bibi Hakimeh, 1961	4,570	17	33			29.9
		Binak, 1959	10,440		4			29.9
		Chilingar, 1974	9,350		1			33.5
		Cheshmeh Khush, 1967	10,700		5			37.7
		Dehluran, 1972	11,900		6			34.8
		Gachsaran, 1937	5,400	46	62			31.0
		Haft Kel, 1927	5,980	2	12			37.7
		Karanj, 1963	6,960	7	7			33.4
		Kharg, 1961	10,900		1			33.6
		Kupal, 1965	10,500		1			32.8
		Labe Safid, 1968	9,350		1			35.3
		Marlavi, 1963	7,100	1	4			34.4
		Marun, 1963	9,400	55	110			30.6
		Masjide Soleiman, 1908	1,600	1	14			33.5
		Naft Safid, 1938	5,000	1	13	2,246,700	36,671,592,200	36.8
		Parsi, 1964	9,670	1	1			38.5
		Parsi Sofla, 1964	9,850		1			37.7
		Pazanan, 1961	7,250	23	27			31.2
		Rag-e Safid, 1964	7,150	13	14			34.5
		Ramin, 1966	12,250		1			33.4
		Ramshir, 1962	8,250		1			37.8
		Salabedar, 1971	9,400		1			30.4
		Naft-e Shah, 1908	2,000–3,000					34.3
		• Bahregansar, 1965	9,000					31.8
		• Heidari, 1968	11,000					33.0
		• Nowruz, 1966	8,200					35.0
		• Rakhsh, 1963	7,650					35.4
		• Rostam, 1966	7,000					34.2
		• Ardeshir, 1969	7,800					32.0
		• Cyrus, 1962	7,000					35.3
		• Darius, 1962	11,000					34.2
		• Fereidoon, 1966	7,000					34.7
		• Sassan, 1965	7,800–8,100					34.1
		Total Iran		361	618	2,246,700	36,674,592,200	
IRAQ[e]	INOC	Abu Ghirab, 1971	9,800	12	16			34.0
		Ain Zalah, 1939	5,200–6,500	35	37			37.0
		Bai Hassan, 1953	8,400–9,400	56	84			34.0
		Badra, 1985	4,000–7,000	4	4			25.0
		Balad, 1953	3,900	2	13			31.0
		Buzurgan, 1976	12,000	20	20			34.0
		East Baghdad, 1979	9,000–10,000	62	79			34.0
		Hamrin, 1973	12,000	14	14			40.0
		Jabal Fauqui, 1974	10,000	20	21			29.0
		Jambur, 1954	5,900–12,000	21	24	1,695,000	31,113,808,000	38.0
		Kirkuk, 1927	2,600–12,200	71	84			36.0
		Lahab, 1961	8,200	12	22			33.0
		Naft Khaneh, 1923	4,500	5	11			32.0
		Nafte Khaneh, 1949	8,000	6	13			42.0
		Qaiyarah, 1939	900	44	50			18.0
		Rumaila North, 1958	10,500	503	513			34.0
		Rumaila South, 1953	10,200	133	208			34.0
		Subbiyah, 1978	9,900	12	33			27.0
		West Qurna, 1985	8,200	2	6			23.0
		Zubair, 1949	10,800	76	120			44.0
[e]Not yet on production		Total Iraq		820	1,511	2,688,000	20,613,808,000	
ISRAEL	LAPIDOTH	Helez Brur, 1955	5,200	4	18	77	22,603,788	29.7
		Kochav, 1962	9,500	8	13	1,061	4,212,163	27.9
	DEIL	Avshalom, 1976	8,400	1	1	34	254,000	42.5
	EMOG	Tamar, 1984	1,980				6,950	37.0
		Total Israel		12	33	372	16,737,951	
ITALY	ELF	• Rospo Mare, 1975	4,600	4	10	17,864	17,874,773	32.0
		• Santa Maria a Mare, 1974	7,900	5	11	3,196	17,852,610	23.0
		• Serapo Mare, 1979	5,300	5	5	4,857	9,121,387	8.0
	AGIP	Cavone, 1979	10,663–16,068	13	15	3,809	7,620,950	24.0
		Cela Mare, 1969	10,800	12	18	2,809	14,997,549	30.0

WORLDWIDE PRODUCTION

			Name of field, discovery date	Depth, ft	No. of wells: Producing	No. of wells: Total	Production: 1988 average B/d	Production: Cumulative to Dec. 31, 1988 Bbl	API gravity
		MONTEDISON[e]							
			Total Italy		193	270	90,941	390,106,332	
IVORY COAST		SIOP[e]	•						
		PHILLIPS-AGIP-SEDCO-PETRIOC	•						
			Total Ivory Coast		17	26	12,037	47,899,558	
JAPAN[c]		JAPEX	•						
		IDEMITSU OIL DEVELOPMENT CO. LTD.	•						
		TEIKOKU OIL							
			Total Japan		387	606	12,300	144,124,800	
JORDAN		NRA							
			Total Jordan		3	17	500	427,000	
KUWAIT[c]		KOC							
			Total Kuwait		363	743	1,335,000	23,138,608,000	
LIBYA		AGIP							
		ELF							
		LNOC[e]							

WORLDWIDE PRODUCTION

		Name of field, discovery date	Depth, ft	No. of wells: Producing	No. of wells: Total	Production: 1988 average B/d	Production: Cumulative to Dec. 31, 1988 Bbl	°API gravity
		Gialo, 1961	2,200-6,300					35.7
		Harsh, 1978	7,400	491	491	858,728	15,644,076,770	34.6
		Khalifa, 1978	5,400-7,000					34.6
		Masrab, 1978	10,000					39.6
		Samah, 1961	9,000					33.4
		Waha, 1960	6,000					36.0
		Zaggut, 1962	6,000					36.4
		Balat, 1983	5,100-5,400					32.2
		Ali, 1975	3,900	1	2			50.0
		Almas, 1975	4,000	5	8			49.5
		Intisar A, 1967	9,750	8	19			45.0
		Intisar B, 1974	9,600	2	2			50.0
		Intisar C, 1967	9,650	1	6			37.5
		Intisar D, 1967	9,400	19	27			39.0
		Intisar E, 1968	5,300-7,100	8	11			34.7
		Nafoora-Augila, 1966	2,200-10,000	13	55			35.5
		Aswad, 1978	6,250	8	8			46.0
		Sabah, 1977	5,500	36	38			42.0
		Zella, 1977	6,750	27	31			48.1
		Other	7,900-8,900	1	2			40.4
		Fidaa, 1979	7,000	9	9			41.7
		Hakim, 1978	6,700	3	3			48.5
		Total Libya		678	770	1,025,000	16,509,480,252	
MALAYSIA	ESSO MALAYSIA[e]	• Bekok, 1976	5,500	23	30			47.0
		• Pulai, 1973	4,300	23	32			42.3
		• Tapis, 1975	6,700	70	106			45.0
		• Kepong, 1979	6,000	3	10			47.0
		• Irong, 1978	5,800	28	42			47.0
		• Tinggi, 1980	4,400	26	31	304,000	706,000,000	48.0
		• Irong Barat, 1979	3,300	10	12			35.0
		• Semangkok, 1980	3,700	5	5			42.5
		• Guntong, 1978		9	14			
		• Palas, 1979		11	11			
		• Tabu, 1978		9	13			
		• Seligi, 1988						
	SARAWAK SHELL BERHAD	• D-18, 1981	4,000	5	5	3,550	2,899,000	39.9
		• Temana, 1972	3,100	19	29	9,560	40,199,000	35.0
		• Bayan, 1976	4,200	2	4	13,110	26,498,000	37.3
		• Other	5,600-11,000	29	33	10,930	268,726,000	
	SABAH SHELL	• Barton, 1971	2,400	4	4	3,010	10,402,000	37.0
		• South Furious, 1974	3,300	7	15	3,010	13,499,000	30.0
		• St. Joseph, 1975	2,200	11	14	16,360	20,271,000	32.0
		• Erb West, 1977	6,785	15	19	6,630	21,620,000	30.0
		• Samarang, 1972	5,700	56	80	59,840	257,301,000	37.0
		• Ketam, 1977	4,800	1	4	270	999,000	30.0
	PETRONAS CARIGALI[e]	• Tembungo, 1971	6,000	8	16			40.0
		• Fairley Baram, 1973	8,655		2			39.5
	SARAWAK SHELL PETRONAS CAG[e]	• Baronia, 1967	7,900	19	40			42.0
		• Betty, 1967	7,900	13	17	108,410	415,152,000	38.0
		• Tukau, 1966	5,000	36	48			29.2
		• Bokor, 1972	2,000	18	19			35.0
		• Siwa, 1973	4,100	4	4			25.0
		Total Malaysia		467	670	540,000	1,792,374,060	
MEXICO[e]	NORTH ZONE, NE	Mision, 1945	5,440	3	3			
		Monterrey, 1950	6,510	5	6			
		Tigrillo, 1971	3,342		11			
	NORTH ZONE, N.	• Arenque, 1970	11,362	17	17			26.0
		Constituciones, 1956	6,350	176	176			17.0
		Ebano-Panuco, 1971	1,450	324	324			12.0
		Tamaulipas	4,200	152	162			19.0
	NORTH ZONE, S.	Chicontepec, 1973	4,264	220	220			34.1
		• Isla de Lobos, 1963	6,875	9	9			40.0
		• Marsopa, 1974	10,198	7	7			39.0
		Naranjos-C. Azul, 1909	1,800	206	206			22.0
		Tres Hermanos, 1959	6,960	34	34			21.0
		Other						
	CENTRAL ZONE, POZA RICA	• Atun, 1966	9,040	7	7			37.0
		• Bagre, 1973	10,919	8	8			33.0
		Escolin, 1942	7,216	95	95			26.3
		Hallazgo, 1955	10,170	36	36			25.0
		Jiliapa, 1958	7,390	29	29			24.0
		Mecatepec, 1941	7,544	32	32			29.8
		Miquetla, 1959	6,480	57	57			35.0
		Poza Rica, 1930	7,090	132	132			35.0
		Pres. Aleman, 1949	8,036	86	86			26.0

WORLDWIDE PRODUCTION

	Name of field, discovery date	Depth, ft	No. of wells: Producing	No. of wells: Total	Production: 1988 average B/d	Production: Cumulative to Dec. 31, 1988 Bbl	°API gravity
	Remolino, 1962	10,745	36	36			29.5
	San Andres, 1956	10,410	123	123			29.0
	Other		315	316			
CENTRAL ZONE, CUENCA DEL PAPALOAPAN	Matapionche, 1974	11,129	29	45			35.6
	Other		22	31			
SOUTHERN ZONE, NANCHITAL	Ixhuatlan Ote, 1965	1,960	20	41			22.6
	Mololoan, 1962	500	170	207			22.3
	Santa Rosa, 1952	1,412	6	9			25.4
CENTRAL ZONE, N. FAJA DE ORO	Acuatempa, 1956	4,085	6	6			21.0
	Mora, 1965	3,866	11	19			17.0
	Ortiznez, 1952	5,220	8	8			21.0
	Oxiteipec, 1953	3,747	13	13			20.0
	Santa Agueda, 1953	4,760	3	3			16.0
	Other		57	57			
SOUTHERN ZONE, EL PLAN	Agata, 1956	9,833	9	15			
	Bacal, 1976	9,500	24	40			35.0
	Concepcion, 1974	1,600	8	18			31.0
	Cuichapa, 1935	2,200	63	123			30.0
	El Plan, 1941	1,700	67	86			30.0
	La Amarga, 1973	1,700	18	27			26.3
	Los Soldados, 1953	4,492	18	22			32.0
	Other		26	38			
SOUTHERN ZONE, AGUA DULCE	Blasillo, 1967	7,216	31	58	~2,606,000	~15,630,240,000	40.0
	Cinco Presidentes, 1960	6,862	73	134			35.0
	Rojo, 1931	2,200	23	36			26.0
	Jenta, 1954	4,730	20	83			41.0
	Ogarrio, 1957	5,790	67	194			38.0
	Otates, 1965	7,469	10	18			39.0
	Retador, 1971	11,338	14	14			26.0
	Sanchez Magallanes, 1957	4,240	73	345			27.0
	San Ramon, 1967	9,517	29	69			30.0
	Tonala, 1928	1,770	31	61			28.0
	Other		3	15			
SOUTHERN ZONE, COMALCALCO	Agave, 1977	13,450	7	16			41.7
	Arroyo Zanapa, 1978	14,599	1	2			38.9
	Arteza, 1972	11,800	3	5			26.4
	Ayapa, 1972	8,200	3	5			7.2
	Carlos Lopez, 1977	14,250	1	1			29.0
	Carlos, 1972	14,100	14	30			31.5
	Carrizo, 1962	4,920	16	35			23.3
	Castarnica, 1967	10,080	38	59			29.3
	Comapa, 1974	14,432	4	6			44.5
	Copapa, 1977	11,890	9	10			43.9
	Cunzacan, 1974	13,775	13	42			28.9
	El Golpe, 1963	3,500	93	135			25.7
	Giraldas, 1977	15,225	21	22			37.0
	Iride, 1974	13,775	12	16			28.5
	Muspac, 1980	9,676	1	13			57.0
	Mecatepec, 1957	2,200	17	30			8.6
	Mora, 1981		61	63			38.1
	Mundo Nuevo, 1977	11,800	4	5			46.0
	Nispero, 1974	14,100	4	18			34.4
	Paredon, 1978	15,690	12	13			39.8
	Quetzalque	11,150	5	21			29.1
	Platanal, 1978	15,900					30.2
	Rio Nuevo, 1975	14,950	5	5			34.8
	Samaria (Cret), 1973	14,209	26	49			31.0
	Santuario, 1966	9,617	28	37			37.0
	Sitio Grande, 1972	13,766	19	23			35.0
	Sumuapa, 1978	12,887	7	7			32.8
	Tapijulapa, 1982	15,613	1	12			39.8
	Tintal, 1968	5,904	4	6			22.0
	Topen, 1978	11,172	2	3			25.4
	Tupilco, 1959	9,686	67	101			27.0
	Benita, 1982	17,056	9	12			41.0
	Canteras, 1979	17,548	26	45			38.0
	Chiapas, 1979	12,136	6	7			42.0
	Fenix, 1979	17,876	4	7			40.0
	Iris, 1975	14,432	8	8			39.2
	Jujo, 1980	17,548	18	19			32.0
	Caparroso, 1982	18,368	1	1			41.2
	Tecominoacan, 1983	19,619	1	5			37.5
	Jolote, 1983	18,119	1	1			39.4
	Artesa Terc, 1984		2	3			28.0
	Carmito, 1980	10,050	1	1			45.6
	Eden, 1983	17,590	1	2			38.5
	Samaria Terc, 1965	4,920	16	23			13.9
	Other		16	37			
GULF OF CAMPECHE	• Cantarell, 1976	8,528	63	75			21.3
	• Abkatun, 1978	11,800	25	35			30.0

WORLDWIDE PRODUCTION

		Name of field, discovery date	Depth, ft	No. of wells: Producing	No. of wells: Total	Production: 1988 average B/d	Production: Cumulative to Dec. 31, 1988 Bbl	°API gravity
		• Ku, 1979	10,000	8	15			22.0
		• Pol, 1979	12,600	8	8			35.0
		• Chuc, 1982	13,100	1	3			35.0
		• Ixhc, 1984		1	2			35.0
		Total Mexico		3,768	5,120	2,606,000	15,630,240,000	
MOROCCO[e]		Essaouira		4	4	300	16,266,800	
		Rharb, 1951	4,590	1	1			
		Total Morocco		5	5	300	16,266,800	
NETHERLANDS	UNOCAL	• Helder, 1980	4,800	11	13	7,453	19,528,211	21.6
		• Helm, 1979	4,400	7	8	1,723	7,627,815	17.9
		• Hoorn, 1981	5,000	7	7	5,183	19,277,390	25.8
	NAM	De Lier, 1955	5,200	23	33	660	16,905,000	33.2
		Rotterdam, 1984		9	9	2,220	2,246,000	30.5
		Pernis West, 1987				100	37,000	28.2
		Berkel, 1954		17	17	3,090	5,831,000	32.0
		Ijsselm, 1956	5,200	59	86	5,240	90,718,000	26.8
		Pijnacker, 1955		4	5	630	6,231,000	36.3
		Wassenaar, 1956	4,200	28	41	1,380	47,005,000	18.7
		Zoetermeer, 1957	4,200	40	30	770	10,082,000	16.5
		Werkendam, 1958				20	207,000	33.0
		Schoonebeek, 1944	2,500	76	495	9,210	235,371,000	12.3
	CONOCO	• Kotter, 1980	6,900	8	10	17,985	31,474,549	33.0
		• Logger, 1982	6,500	6	8	9,984	12,393,941	33.5
	AMOCO	• Rijn, 1982	6,600	12	25	9,950	14,614,903	35.0
		Total Netherlands		289	780	75,998	519,599,809	
NEUTRAL ZONE	AOC	• Hout, 1969	5,620-15,500	23	34	23,906	280,129,303	33.0
		• Khafji, 1961	4,400-10,300	135	165	163,504	2,441,476,353	28.2
	TEXACO & KOC[e]	S. Fuwaris, 1963	6,800	9	9	2,000	22,000,000	25.0
		S. Umm Gudair, 1966	8,400	16	17	36,000	436,050,000	24.3
		Wafra, 1953	1,100-7,000	322	427	98,000	1,378,000,000	18.9-23.5
		Total Neutral Zone		501	652	323,410	4,457,605,656	
NEW ZEALAND	SHELL-BP-TODD	• Kapuni, 1959	11,700	11	14	5,935	41,170,000	54.0
		• Maui, 1969	11,000	14	14	6,795	28,700,000	51.0
	PCNZ	Ahuroa, 1987		1	1	*852	9,800	46.1
		Kaimiro, 1962	11,400	1	1	*74	318,000	42.0
		McKee, 1980	7,838-8,051	19	19	9,984	13,745,000	38.5
		Tariki, 1986		1	1	*1,474	14,000	52.7
		Waihapa, 1988		2	2	*2,948	1,077,000	36.6
*Production rates only. No permanent production facilities in place.		Total New Zealand		49	52	28,057	84,873,800	
NIGERIA	AGIP	Agae, 1975	10,800	1	1	110	2,042,504	50.1
		Awo, 1967	9,600-10,600	3	11	1,862	60,056,817	40.1
		Awo West, 1972	9,900-10,200		2		482,258	31.4
		Ashaka, 1968	9,700-12,000	1	1	1,145	2,762,447	38.4
		• Bentoye N., 1978	9,000-10,000	9	9	8,904	11,572,397	29.6
		Bemkia, 1974	12,000		2		3,309,326	29.5
		Clough Creek, 1977	10,000-12,400	7	9	7,439	22,460,507	29.3
		Ebegoro, 1976	11,800-12,000	7	9	7,509	62,109,913	35.7
		Ebocha, 1965	8,000-10,900	8	16	6,959	110,337,245	35.5
		Idu, 1973	7,750-10,700		10		13,862,581	28.0
		Kwale, 1967	10,000-11,500	8	10	7,667	7,500,675	36.4
		M Bede, 1966	7,300-9,400	10	20	14,132	163,238,542	40.9
		Obama, 1973	11,600-14,300	6	8	14,677	97,780,167	37.2
		Obiafu, 1967	9,300-12,200	18	20	15,815	85,766,070	42.4
		Obrikom, 1973	8,000-10,000	6	13	3,371	55,040,901	45.1
		Oduge, 1972	12,500	2	2	634	9,788,065	47.2
		Ogbogene, 1972	10,000		2		3,302,763	37.0
		Ogbogene W., 1982	13,000		1		353,136	56.2
		Okpai, 1968	10,000-12,000	8	8	4,779	19,031,162	44.6
		Omoku W., 1975	11,500		1		4,746,492	27.4
		Oshi, 1972	9,600-11,300	10	11	9,890	66,552,033	34.1
		Tebidaba, 1975	10,300-13,800	7	10	17,017	118,463,094	33.0
		Umuoru, 1975	14,100	3	4	2,477	5,353,184	40.0
	ASHLAND	Adanga, 1980	10,611-17,586	9	9	12,953	15,386,228	35.0
		• Akam, 1980	6,700	10	10	7,561	5,802,362	35.2
		• Izombe-Oshu, 1974	9,500	8	8	13,262	10,645,430	35.0
		Ebughu, 1983	7,250	3	3	457	167,263	21.0
	ELF	Aghigo, 1972		17	29	4,466	24,405,554	24.8
		Erema, 1972		4	5	4,715	10,847,810	24.6
		Obagi, 1964		61	68	48,743	368,074,953	24.6

WORLDWIDE PRODUCTION

	Name of field, discovery date	Depth, ft	No. of wells: Producing	No. of wells: Total	Production: 1988 average B/d	Production: Cumulative to Dec. 31, 1988 Bbl	°API gravity
	Obodo-Jatum, 1966		42	18	16,116	69,115,408	24.8
	Okpoko, 1967		16	17	7,304	32,326,957	24.8
	Utamini, 1965		14	14	3,600	16,898,167	24.8
GULF NIGERIA	Abiteye, 1970	5,750- 9,400	10	19	5,294	64,007,733	39.7
	• Delta, 1965	5,600- 9,500	20	27	18,566	169,822,039	37.3
	• Delta South, 1965	7,100-10,179	18	28	31,483	269,735,952	38.4
	• Isan, 1970	5,900- 9,000	6	11	2,369	42,897,085	40.4
	Jisike, 1975	6,300- 7,600	1	4	1,589	6,338,968	41.1
	Makaraba	7,100-12,005	20	25	20,813	92,637,107	27.7
	• Malu, 1969	4,800- 6,300	12	19	16,371	102,394,051	40.4
	• Meta, 1965	8,570-12,093	5	5	5,832	67,968,438	38.1
	• Meji, 1965	8,200-10,900	19	22	18,979	151,312,520	31.9
	• Meren, 1965	5,000- 7,500	51	56	57,685	493,040,316	31.9
	• Okan, 1964	5,500- 9,245	55	71	33,485	390,246,940	38.1
	• Parate Ext, 1968	4,500- 8,200	13	26	10,783	103,215,846	40.4
	Robertkiri, 1964	11,484-14,140	10	12	10,403	12,516,783	40.2
	• Tapa, 1978	8,150-10,842	8	10	9,233	28,142,426	39.5
	Utonana, 1971	7,400- 9,165	2	5	816	8,165,121	20.4
	• W. Isan, 1971	7,805-10,209	6	9	8,011	44,745,318	40.4
	Yoka South, 1974	11,389-12,635		2		834,040	41.0
MOBIL	• Adua, 1967	6,970	6	5	10,768	48,537,242	30.3
	• Asabo, 1966	5,600	9	14	15,175	161,113,170	30.4
	• Asabo D		1	2	1,241	8,250,081	35.0
	• Ata					433	
	• Expe, 1966	8,200	8	17	9,611	188,394,905	30.3
	• Expe WW, 1977	6,820	5	6	7,449	190,382,525	30.3
	• Exu, 1966	5,420	3	3	3,178	15,955,736	30.8
	• Erang, 1968	6,600	18	23	23,127	85,960,995	35.1
	• Etim, 1968	6,200	7	9	16,984	112,511,703	32.9
	• Idoho, 1966	4,000	3	4	1,017	28,842,611	30.8
	• Inim, 1966	5,850	7	10	14,463	145,437,397	37.8
	• Isobi, 1968	5,435	4	5	4,263	8,180,634	30.8
	• Iyak SE		6	5	16,155	10,682,165	38.7
	• Mfem, 1967	5,200	2	4	4,185	25,627,206	36.1
	• Oso						
	• Ubit, 1968	5,400	38	45	75,322	185,674,628	35.1
	• Unam, 1968	5,980	7	8	9,744	33,881,140	33.5
	• Usari					5,885	
	• Utue, 1966	5,700	5	7	8,651	70,170,635	36.8
	Etop		3	4	21,956	8,394,906	37.7
PAN OCEAN (NIGERIA)	Opharefe, 1973	9,900	2	2	2,764	4,843,444	37.4
SHELL[e]	Ugh-Ogini, 1964	5,860	1	17			34.0
	Ugh-Ozore East, 1960	8,500	2	4			23.0
	Ugh-Ozore West, 1961	8,500	12	11			28.0
	Ugh-Otumara, 1963	7,000-10,000	26	52			32.0
	Ugh-Owiti, 1964	12,300	11	11			28.0
	Ugh-Kokori, 1960	8,000- 9,800	63	77			42.0
	Ugh-Afiesere, 1966	8,000- 9,000	50	43			22.0
	Ugh-Eremu, 1961	10,500	13	14			29.0
	Ugh-Ughelli East, 1959	11,800	10	13			35.0
	Ugh-Ughelli West, 1963	9,400-10,200	8	10			21.0
	Ugh-Utimaga, 1964	9,000	14	19			25.0
	Ugh-Orogo, 1964	12,000		8			22.0
	Ug.-Warri River, 1961	12,264	2	3			41.0
	Ugh-Evwreni, 1968	10,900	10	11			38.0
	Ugh-Isoko, 1960		1	2			19.0
	Forc-Obiti, 1967	10,940	25	60			37.0
	Forc-Opukush, 1963	7,823	12	17			29.0
	Forc-Jones Creek, 1967	9,000- 9,000	31	34			29.0
	Forc-Opuama, 1973		3	5			41.0
	Forc-Egwa, 1967	9,350	20	24			37.0
	Forc-Forcados Yoke, 1968	10,859	61	92			22.0
	Forc-Batan, 1968	11,000	8	9			27.0
	Forc-Excravos Beach, 1964	8,176	9	13	64,000	221,969,139	36.0
	Forc-Otumara, 1969	8,176	26	29			25.0
	Forc-Saghara, 1970	9,500	5	6			31.0
	Forc-Ajapa, 1970	13,424	1	2			27.0
	Forc-Benisede, 1973		15	19			24.0
	Node-Saparai, 1970	12,788	14	19			42.0
	Node-Oben, 1972	12,010	14	23			40.0
	Forc-Opukush N., 1977		1	2			30.0
	Abura		1	3			44.8
	Rapele		1	3			44.4
	Amukpe		1	2			38.0
	Okwa		2	2			
	Phi-Bomu, 1958	6,500- 7,500	12	40			36.0
	Phi-Imo River, 1959	5,800-10,000	68	92			32.0
	Phi-Nkali, 1963	12,000	4	10			42.0
	Phi-Ebelenwa, 1959	11,000	6	11			34.0
	Phi-Umuechem, 1969	5,800-10,700	8	19			36.0
	Phi-Apara, 1960	9,000	1	8			36.0

WORLDWIDE PRODUCTION

		Name of field, discovery date	Depth, ft	No. of wells: Producing	No. of wells: Total	Production: 1988 average B/d	Production: Cumulative to Dec. 31, 1988 Bbl	°API gravity
		Phl-Bodo West, 1959	9,700	9	11			29.0
		Phl-Afam, 1956	6,000	6	15			45.0
		Phl-Yorla, 1970	11,917	8	13			44.0
		Phs-Bonny, 1959	12,254	9	15			36.0
		Phs-Cawthorne Channel, 1963	11,000	21	30			38.0
		Phs-Ekulama, 1958	10,483	23	29			32.0
		Phs-Soku, 1958	11,500	18	23			31.0
		Phs-Orubiri, 1971*		2	6			38.0
		Egb-Oguta, 1965	10,300	6	22			46.0
		Eade-Utapate South, 1974		7	11			44.0
		Eade-Opobo South, 1974		4	6			44.0
		Ibigwe		1	2			
		Korokoro		6	8			34.3
		Otamini		3	5			21.8
		Ugada		1	1			
		Ahia		9	13			38.2
		Akpor			3			27.5
		Alakiri		12	21			38.2
		Assa		2	2			20.7
		Egbema West		7	17			42.2
		Ebubu		2	8			22.2
		Egbema		6	7			35.5
		Cesw-Nun River, 1960		4	6			39.0
		Cesw-Etelebou, 1971	12,000	9	9			33.0
		Cesw-Kolo Creek, 1960	12,000	15	25			42.0
		Cesw-Diebu Creek, 1966		9	12			43.0
		Phl-Isimiri, 1964	5,900-11,000	4	6			28.8
		Phl-Onne, 1965	10,384	3	3			29.0
		Phl-Obigbo North, 1963	6,500-10,000	25	38			22.0
		Phl-Ajokpori, 1967		2	2			29.0
		Phl-Agbada, 1960	8,000-12,000	35	46			32.1
		Phl-Akuba, 1967		1	1			29.0
		Cesw-Adibawa, 1967	11,950	12	23			26.0
		Cesw-Adibawa NE, 1973		3	3			26.0
		Cesw-Ubie, 1961	14,380	5	6			28.0
		Phl-Obeakpu, 1975		2	4			46.0
		Cosw-Nembe Creek, 1973		36	38			35.0
		Phs-Akaso, 1979		1	1			30.0
		Bugama Creek		5	7			43.0
		Kalaekule		7	7			39.6
		Krakama		6	10			23.8
		Odeama Creek		5	6			35.3
		Tai		2	2			37.4
		Obele			5			
		Rumuekpe		2	3			
		Enwhe			2			
		Akaso			1			
	TEXACO-CHEVRON-NNPC	• Funiwa, 1978	5,000-7,000	20	22	22,177	43,904,568	38.2
		• Middleton, 1972	5,000-7,000	3	7	2,363	15,813,022	36.6
		• North Apoi, 1973	4,000-8,100	22	26	33,776	162,994,363	35.8
		• Pennington, 1965	5,000-10,400	1	10	2,000	35,109,345	38.2
		• Sengana, 1967	11,400-12,500		2		666,120	46.7
		Total Nigeria		1,513	2,187	1,390,000	12,96,728,331	
NORWAY	AMOCO	• Valhall, 1972	8,200		22	63,426	103,147,000	35
	BP	• Ula, 1976	11,000	6	10	35,489	69,591,614	33.4
	CONOCO	• Murchison, 1975	9,900	4	6	13,126	47,716,447	35.1
	NORSK HYDRO	• Oseberg, 1979	7,600	7	14	14,350	13,942,000	34.1
	PHILLIPS	• Albuskjell, 1972	10,400	13	34	3,000	41,344,674	45.1
		• Cod, 1968	9,500	6	7	1,724	16,434,501	44.2
		• Edda, 1972	10,480-10,600	7	7	1,444	23,440,123	41.5
		• Ekofisk, 1968	10,000	40	42	110,445	990,746,347	41.3
		• Eldfisk, 1970	9,350-10,000	35	64	74,000	290,148,432	37.6
		• Tor, 1970	10,000	10	13	9,800	118,225,861	35.0
		• West Ekofisk, 1970	10,300	10	13	4,895	91,253,278	44.4
	STATOIL	• Gullfaks, 1978	9,850-9,700	15	21	148,522	74,900,000	29.3
		• Statfjord, 1974	9,500	48	57	566,344	1,241,447,969	39.0
		Total Norway		223	285	1,141,099	3,032,088,436	
OMAN	PDO	Al Burj, 1987	6,890	3	4	1,000	315,000	26.0
		Al Ghubar, 1974	1,916	4	6	3,000	5,031,000	21.0
		Al Huwaisah, 1969	5,320	38	39	15,000	171,061,000	37.0
		Amal/Amal South, 1973	4,638	32	35	12,000	11,950,000	24.0
		Anzauz, 1984	7,098	3	3	4,000	6,918,000	46.0
		Bahja, 1984	5,697	6	11	11,000	8,176,000	49.0
		Barik, 1974	8,856	3	3	3,000	2,516,000	48.0
		Birba, 1978	8,528			2,000	582,000	30.0
		Burhaan, 1984	4,011	1	3	1,000	1,635,000	37.0

WORLDWIDE PRODUCTION

		Name of field, discovery date	Depth, ft	No. of wells: Producing	No. of wells: Total	Production: 1988 average B/d	Production: Cumulative to Dec. 31, 1988 Bbl	°API gravity
		Dhiab, 1985	5,414	6	6	1,000	629,000	26.5
		Fahud, 1964	2,499	155	212	63,000	774,176,000	32.5
		Fayyadh, 1983	3,608	1	1	535	503,000	27.0
		Ghaba North, 1972	2,227	14	25	8,000	52,828,000	34.5
		Habur, 1975	5,800	1	2	205	4,396,000	14.8
		Hasirah, 1984	8,708	9	12	5,000	3,773,000	50.0
		Ishaq, 1984	5,578	3	4	1,500	672,000	27.5
		Jalmud, 1979	4,236	3	3	310	377,000	22.5
		Jalmud North, 1980	4,265	2	2	310	252,000	22.5
		Jameel, 1984	5,906	3	4	1,000	482,000	30.2
		Jawdah, 1984	3,570	3	3	2,000	1,700,000	22.0
		Karim West, 1982	3,546	20	20	11,000	13,836,000	23.0
		Kaukab, 1983	8,282		1	900	1,258,000	32.0
		Lekhwair, 1968	4,352	46	63	23,000	65,406,000	38.6
		Mahdur, 1979	11,700	1	3	1,000	2,264,000	37.2
		Marmul, 1977	5,087	167	181	39,000	124,522,000	22.3
		Mawhoob, 1985	6,562	1	1	92	82,000	25.7
		Mukhaizna, 1975	3,478				12,400	15.0
		Natih, 1963	4,788	29	67	27,000	351,568,000	31.0
		Nimr, 1980	3,296	93	96	34,000	24,527,000	21.3
		Qahaan, 1978	4,536	24	29	7,000	24,737,000	39.4
		Qahaan East, 1978	4,936	2	4	184	734,000	30.4
		Qarn Alam, 1972	1,354	4	7	1,000	19,470,000	16.0
		Qata, 1979	4,707	4	14	2,000	4,462,000	26.2
		Rahab, 1977	3,237	19	25	3,000	6,478,000	25.0
		Ramlat Rawl, 1987	2,720	1	1	395	144,000	39.7
		Rasha, 1982	4,310	4	6	1,000	1,258,000	32.8
		Rima, 1979	3,247	43	44	64,000	188,925,000	32.8
		Ruhib, 1978	3,215	7	7	2,000	1,887,000	20.3
		Saih Nihaydah, 1972	8,700	19	25	3,000	157,864,000	39.4
		Saih Rawl, 1973	9,826	14	14	10,000	92,191,000	39.7
		Sayyala, 1981	3,690	11	11	29,000	29,558,000	47.9
		Shibkah, 1976	2,591	1	2	164	821,300	31.0
		Simsim, 1985	5,250	9	10	5,000	2,893,000	28.1
		Suwaihat, 1982	6,452	8	12	9,000	11,320,000	44.1
		Thuleilat, 1986	3,773	11	11	5,000	1,887,000	23.0
		Wafra, 1983	6,510	3	7	2,000	1,887,000	36.5
		Warad, 1985	4,927	3	3	1,000	629,000	28.4
		Yibal, 1962	8,465	174	186	164,000	666,634,000	39.6
		Zahra, 1986	6,562	2	2	1,000	371,000	32.1
		Zareef, 1985	3,264	7	8	8,000	6,284,000	47.0
		Zauiyah, 1981	8,177	9	13	6,000	10,578,000	47.0
	ELF GROUP	Ramlat		1	1	72	122,105	
		Sahmah, 1978	12,400	7	7	5,000	24,539,461	45.1
	OCCIDENTAL	Safah, 1983	6,500	54	54	15,400	8,840,000	42.0
		Total Oman		1,093	1,342	615,067	2,835,850,286	
PAKISTAN	PAKISTAN OILFIELD LTD.	Baikassar, 1946	9,398	2	4	433	31,530,844	26.0
		Dhodiani, 1936	8,894	14	41	34	41,314,774	48.0
		Meyal, 1968	12,513	8	10	3,436	29,996,654	41.5
		Joya Mair, 1944	6,900	2	3	225	5,763,547	19.0
		Khaur, 1915	9,306	1	3	8	4,167,349	33.0
	PAKISTAN PETROLEUM LTD.	Adhi, 1978	9,118–9,190		4		1,416,737	48.5
	OGDC	Chak Naurang, 1986	9,187	2	4	731	54,808	14.3
		Fimkassar, 1982	11,465	1	1	2	31,809	49.1
		Ghotana, 1986	7,874	2	2	179	116,292	42.1
		Tando Alam, 1984	7,546–8,205	9	14	2,675	4,566,054	41.4
		Thora, 1987	7,546	2	3	3,268	286,311	
		Toot, 1968	15,175	14	15	1,307	4,428,741	38.0
		Soru, 1988	7,618	2	4	1,216	403,674	
		Lashari Centre, 1988	7,218	1	2	105	38,402	
	UNION TEXAS	Dabhi, 1984	5,975	1	4	1,172	1,791,000	34.0
		Khaskeli, 1981	3,600	4	9	760	7,068,000	39.0
		Laghari, 1983	7,500	5	7	6,250	12,096,000	42.0
		Mazari, 1985	3,520	5	5	6,400	4,560,000	43.0
		South Mazari, 1985	3,980	2	3	930	341,000	38.0
		Other			26			32.0–46.0
	OCCIDENTAL	Dhurnal, 1984	13,100	3	6	18,062	22,307,974	38.0
		Total Pakistan		80	170	45,405	176,899,225	
PERU	PETROMAR S.A.	• Litoral, 1955	1,500–6,000	100	140	2,671	37,350,888	36.0–40.0
		• Lobitos, 1960	3,500–7,500	144	209	6,422	62,356,849	38.0
		Pena Negra, 1960	3,000–8,500	147	603	13,047	108,954,305	38.0
		• Providencia, 1967	4,000–7,000	41	84	1,191	21,256,989	38.0–40.0
		Other		3	10	160	255,979	
	OCCIDENTAL	• Bartra, 1979	8,000–8,930	1	16	3,052	18,163,316	11.5
		• Capahuari Sur, 1973	11,800–12,900	17	22	8,992	141,990,083	35.6

WORLDWIDE PRODUCTION

		Name of field, discovery date	Depth, ft	No. of wells: Producing	No. of wells: Total	Production: 1988 average B/d	Production: Cumulative to Dec. 31, 1988 Bbl	°API gravity
		• Dorissa, 1978	9,800-10,600	7	12	7,060	37,168,169	34.0
		• Forestal, 1973	9,000- 9,900	9	11	6,129	34,897,938	26.7
		• Huayuri Sur, 1977	10,000-10,800	7	12	3,190	18,570,907	29.3
		• Ibarito, 1981	9,000- 9,650	5	5	4,948	11,457,819	10.8
		• Ibaro, 1974	10,110-10,155	5	6	3,095	7,468,290	11.3
		• San Jacinto, 1978	7,200- 9,760	10	12	5,601	38,952,534	13.1-23.5
		• Shivayacu, 1973	9,100-10,100	17	24	17,805	65,060,157	20.8
		Other			12	798	2,051,797	
	OCCIDENTAL BRIDAS	Talara area	1,341- 6,080	709	1,292	5,197	46,526,000	34.0
	PETROPERU	Capirona, 1978	9,800-12,800	4	5	726	3,540,092	25.3
		Corrientes, 1971	10,000-12,600	80	96	21,482	94,464,274	29.8
		N. Esperanza, 1980	10,200-10,760	1	3	875	4,869,684	44.0
		Pavayacu, 1972	9,600-11,300	11	14	3,198	16,486,097	30.2
		Selva Central		89	48	4,018	26,401,451	
		Talara Lima area, 1863	2,000- 3,000	1,159	6,068	93,756	954,030,859	34.1
		Valencia, 1975	10,500-11,200	1	1	4	935,748	44.0
		Yanayacu, 1974	11,400-13,600	6	9	628	4,113,104	19.1
		Total Peru		3,478	8,430	143,205	1,727,368,879	
PHILIPPINES	ALCORN PHILIPPINES	• Matinloc, 1978	6,656- 6,750	4	5	1,512	9,448,240	43.8
		• Nido, 1977	6,576- 6,885	1	5	448	14,797,886	27.1
		• North Matinloc, 1987	6,840- 7,021	2	2	887	519,934	43.2
		• Galoc, 1981	7,060- 7,280	1	1	1,051	583,460	37.2
	ALCORN PALAWAN	• Cadlao, 1977	5,734- 5,881	3	3	1,035	9,419,265	39.6
	TRANS ASIA OIL & MINERAL DEVELOPMENT CORP.	• South Tara, 1987	4,346- 4,446	1	1	847	145,885	40.4
		Total Philippines		13	16	5,970	36,014,660	
QATAR[c]	QGPC	• Bul Hanine, 1970	6,000	14	15			35.0
		Dukhan, 1940	6,500	116	161			41.1
		• Idd El Sharqi, 1960	8,250- 8,250	25	31	346,000	4,171,621,000	35.0
		• Maydan Mahzam, 1963	7,000	19	24			38.0
		Total Qatar		174	231	346,000	4,171,621,000	
RAS al KHAIMAH[c]	IPC	• Saleh, 1981	11,500	6	6	10,000	16,491,000	41.0
		Total Ras al Khaimah		6	6	10,000	16,491,000	
SAUDI ARABIA[c]	ARAMCO	Abqaiq, 1940	6,500					37.0
		Abu Hadriya, 1940	9,400					35.0
		Abu Jifan						
		• Abu Safah, 1963	11,000					40.0
		Baer						
		• Berri, 1964	8,400					42.0-44.0
		Dammam, 1938	3,800					35.0
		Dhruf						
		Dibdibah						
		Dijfuf						
		El Haba						
		Fadhili, 1949	8,000					39.0
		Fartak						
		Ferdan						
		Ghawar, 1948	6,400					41.0
		Hahari						
		• Hamur						
		Harmaliyah, 1973	8,100					39.0
		• Harqus						
		• Haradh						
		Jaham						
		Jalamid						
		• Jana						
		Jauf		588	588	1,946,000	58,497,150,000	
		Jawb						
		Juraybiat						
		• Jurayf						
		• Karan						
		Khurais, 1957	9,200					44.0
		Khursaniyah, 1956	6,940					37.0
		• Kurayf						
		• Lawhah						
		Lughfah						
		• Maharah						
		• Manifa, 1957	7,950					
		• Marjan, 1967	6,800					34.0
		Mazalij						
		Qatif, 1945	7,100					33.0-34.0
		Qrdh						
		• Ribyan						
		Rimthan						

WORLDWIDE PRODUCTION

		Name of field, discovery date	Depth, ft	No. of wells Producing	No. of wells Total	Production 1988 average B/d	Production Cumulative to Dec. 31, 1988 Bbl	°API gravity
		• Safaniya, 1951	5,100					
		Sahba						
		Samin						
		Shaar						
		Subai						
		Tinat						
		Wari'an						
		Wattar						
		• Zuluf, 1965	5,800					
		Total Saudi Arabia		588	588	4,946,000	55,957,450,000	
SHARJAH	AMOCO	Saba and Mubarek, 1966	10,000-12,500	16	16	134,140	134,400,000	40.0
	CRESCENT[e]	• Mubarek, 1972		4	4	10,860	66,936,260	37.0
		Total Sharjah		20	20	65,000	201,336,260	
SPAIN	SHELL ESPANA	• Angustia Marin Norte, 1970	10,000			700	55,667,000	37.0
		• Tarraco, 1973	9,000				14,547,000	39.0
	CHEVRON	Ayoluengo, 1963	3,900-7,200	44	44	1,990	15,100,000	24.0
	REPSOL[e]	• Casablanca, 1970	8,900		3			37.0
		• Dorada, 1975	6,900		4			21.0
		• Gaviota, 1980	8,200	1	1	27,310	104,000,000	19.0
		• Sarmiento, 1964	11,600		2			33.0
		Angela, 1964	7,600		19			33.0
		Total Spain		44	73	29,000	193,412,000	
SURINAME	STAATSOLIE	Tambaredjo, 1981	2,300	99	99	3,380	3,481,700	15.0
		Total Suriname		99	99	3,380	3,481,700	
SYRIA	AL FURAT OIL CO. (SHELL)	Thayem, 1983				60,240	97,627,000	36.0
		Ash Shola, 1985				420	150,000	41.0
		Eil Matil North, 1966				8,400	6,934,000	38.1
		Al Khara East, 1968				1,400	2,369,000	38.1
		Isis, 1986				3,400	1,275,000	33.1
		El Anwar, 1986				6,400	1,675,000	32.1
	S.P.C.[e]	Alan, 1974	6,900	2	2			34.0
		Steben, 1978	7,800	2	2			15.0
		Jebisah, 1968	6,900	55	124			34.0
		Karatchok, 1956	6,900	114	114	127,410	200,730,000	34.0
		Rumelan, 1962	6,900	60	60			34.0
		Soudar, 1964	6,900	36	37			34.0
		Tishrine, 1978	7,400	54	71			15.0
		Total Syria		963	1,168	256,000	1,128,027,000	
THAILAND	UNOCAL	• Baanpot, 1980	7,000	4	9	2,290	7,018,400	34.0
		• Erawan, 1973	7,500	62	67	6,270	6,736,000	34.0
		• Platong, 1976	8,500	31	48	4,944	9,524,200	34.0
		• Satun, 1980	4,500	86	94	5,410	6,017,000	34.0
	THAI SHELL	Pra Khathum, 1984	9,842	1	1	90	90,000	39.0
		Sinat, 1981	10,014-9,949	47	63	18,000	64,000,000	41.0
		Sinat West, 1983	9,800	2	2	150	600,000	41.0
		Wat Tam, 1988	7,000	1	1	500	480,000	33.0-41.0
		Total Thailand		245	341	36,910	65,058,700	
TRINIDAD	AMOCO	• Cassia, 1973	12,700	4	8	106	1,564,000	45.0
		Mora, 1986	8,500	4	5	630	630,000	
		• Poui, 1974	11,650	44	57	14,136	157,196,000	44.0
		• Samaan, 1971	11,780	47	54	14,140	174,664,000	36.0
		• Teak, 1971	15,191	64	97	11,464	230,444,000	29.0
	TNA	• Forest Offshore (FOS), 1954		14	39	257	7,500,000	
		• Soldado, 1955	11,000	966	655	88,106	476,627,000	
	TRINTOPEC	Central Los Bajos, 1973		190	218	2,458	9,588,000	
		Coora Quarry, 1936	14,000	155	193	1,641	42,654,000	
		Fyzabad-Apex Quarry, 1900	11,000	418	1,034	5,765	171,978,000	
		Galeota, 1963	6,404	44	105	3,414	16,098,000	
		Palo Seco-Erin McKenzie, 1926	12,738	529	1,576	6,847	220,163,000	
		Other		709	914	7,651	91,340,000	
	TRINTOC	Area IV & Guapo, 1913	10,676	80	130	1,166	34,136,000	
		Barrackpore, 1911	11,100	79	664	3,018	42,928,000	
		Brighton, 1908	7,500	64	619	623	70,374,000	
		Catshill, 1950	4,693	32	134	415	23,143,000	
		Forest Reserve, 1913	11,000	283	2,042	3,980	260,360,000	

WORLDWIDE PRODUCTION

		Name of field, discovery date	Depth, ft	No. of wells — Producing	No. of wells — Total	Production — 1988 average B/d	Production — Cumulative to Dec. 31, 1988 Bbl	°API gravity
		Guayaguayare, 1902	10,750	114	699	2,121	87,253,000	
		Oropouche, 1944	9,100	29	128	196	6,711,000	
		Palo Seco, 1929	12,700	86	933	2,073	93,881,000	
		Parrylands, 1913	10,626	119	508	1,596	40,711,000	
		Penal, 1936	11,067	76	289	989	62,404,000	
		Point Fortin C & W, 1907	10,626	124	551	1,968	41,427,000	
		Grand Ravine,* 1929	11,000	52	168	693	26,860	
		Trinity, 1956	9,700	18	96	239	15,218,000	
		Other		68	813	865	71,477,000	
	P.C.O.L	All fields		96	494	773	20,861,000	
		Total Trinidad		3,255	13,530	150,842	2,445,217,000	

*Formerly Point Fortin East

TUNISIA	ELF-ETAP	• Ashtart	10,500	15	20	25,008	182,579,562	29.8
	ELF-SEREPT	Douleb-Semmama	3,937	12	15	638	17,941,594	40.0
		Tamesmida	3,937	2	2	204	2,086,622	36.9
	SHELL	• Tazerka, 1979		5	5	3,610	14,621,000	30.0
	ETAP-AGIP-FINA (SODEPS)	Debech, 1980	7,550	1	1	11	237,162	42.6
		Larich, 1979	7,560	2	2	20	250,782	40.7
		Makrouza, 1980	6,230	4	5	1,045	4,479,114	45.0
		El Hajeb, 1982	6,840	2	2		1,010,000	30.5
	CFPT[e]	Sidi El Itayem, 1971	7,500–7,800	21	23			44.0
	AGIP-TUNISIA (SITEP)[e]	El Borma, 1964	8,250–8,900	87	113	71,219	546,177,000	42.5
		Chouech es Saida, 1971	12,609	1	1			42.9
		Total Tunisia		152	189	101,755	769,382,856	
TURKEY	ALADDIN MIDDLE EAST LTD	Kahta, 1968	3,500	12	25	155	4,060,627	11.0
		Yasince, 1974	6,400	2	4		1,000	31.0
	MOBIL	Bulgurdag, 1960	4,300	2	2	40	2,481,657	37.2
		Selmo, 1964	5,800	20	20	4,008	66,786,785	34.2
	SHELL	Barbes 4 Derp, 1971		18	27	1,610	16,289,000	37.2
		Bayou, 1985		6	7	960	751,000	34.5
		Bektas, 1985		1	1	220	881,000	34.7
		Beykan, 1964		38	48	2,650	59,770,000	33.2
		Cobanfepe, 1979				50	218,000	29.5
		Katin, 1972		5	8	50	2,718,000	29.7
		Kayakoy, 1960		14	27	1,120	19,710,000	38.2
		Kayakoy West, 1964		14	29	3,300	30,308,000	34.1
		Kervan, 1982				10	4,000	30.4
		Kurkan, 1963		29	35	1,800	49,159,000	31.4
		Kurkan South, 1965		5	10	930	6,940,000	34.5
		Malatepe, 1970		14	15	1,010	7,670,000	32.7
		Pyanko, 1968		1	4	50	1,518,000	35.4
		Sahaban, 1965		7	13	710	13,160,000	34.5
		Sahaban South East, 1983		2	2	190	370,000	34.5
		Sincan, 1979		8	9	740	3,071,000	31.4
		Yatir East, 1973		9	11	630	5,331,000	30.9
		Yenikoy East, 1974		2	2	1,040	4,281,000	31.3
		Yesildere, 1985		3	3	300	310,000	34.5
	TPAO	Adiyaman, 1971	5,800	8	8	640	8,235,615	27.6
		Akpinar, 1984	10,500	4	4	113	139,899	31.6
		Akcakoy, 1983	6,500	1	1	54	82,376	32.0
		B. Firat, 1986	8,150	11	11	1,870	1,447,728	34.8
		B. Kozluca, 1985	5,000	24	24	1,050	1,223,028	12.0
		B. Selmo, 1981	5,500	2	2	690	633,820	34.0
		Bat. Raman, 1961	4,200	96	96	5,470	35,568,535	13.3
		Beycayir, 1976	7,700	1	1	45	197,316	26.1
		Bolukyayla, 1977	10,300				167,663	35.0
		Camurlu, 1976	5,600	20	20	560	1,033,511	12.2
		Cenkli, 1964	10,500	11	11	1,130	3,497,641	35.2
		Cemberitas, 1983	6,500	22	22	3,170	7,190,561	30.5
		Cukurtas, 1985	10,000	1	1	33	212,189	36.0
		Devecatak, 1973	4,800	1	1	65	246,785	37.0
		G. Adiyaman, 1977	5,000				115,836	20.4
		G. Dincer, 1981	5,350	10	10	750	4,532,209	16.7
		G. Kayakoy, 1976	8,600	4	4	620	2,195,433	30.4
		G. Sahaban, 1978	5,450	13	13	1,025	2,940,261	33.2
		G. Sincak, 1973	5,250	13	13	819	4,107,220	31.5
		Garzan, 1956	4,700	19	19	1,290	32,942,472	26.2
		Germik, 1968	6,500	10	10	280	3,400,925	18.8
		Ikiztepe, 1976	4,900		7		88,051	11.3
		Karakus, 1988	8,850	1	1	2,410	70,813	30.0
		K. Osmancik, 1971	3,800	2	2	220	2,089,303	37.6
		Kartaltepe, 1982	6,550	3	3	369	884,472	32.0
		Kurtalan, 1961	5,750	1	1	24	242,639	31.9
		Kuzey Adiyaman, 1977	9,500				59,375	32.0
		Magnp, 1961	5,700	10	10	680	14,871,144	18.4
		Mehmetdere, 1982	6,700	1	1	23	156,982	31.0

WORLDWIDE PRODUCTION

		Name of field, discovery date	Depth, ft	No. of wells Producing	No. of wells Total	Production 1988 average B/d	Production Cumulative to Dec. 31, 1988 Bbl	°API gravity
		Oyaktas, 1972	7,600				592,005	31.0
		Raman, 1940	4,500	83	83	4,810	50,390,274	18.7
		S. Siman, 1987	3,900	4	4	230	60,282	13.0
		Sarikak, 1973	5,250	5	5	300	2,656,363	31.5
		Sezgin, 1970	5,600				87,559	17.0
		Silvanka, 1962	8,200	8	8	840	7,913,037	23.0
		Syuntepe, 1977	8,206	1	1	180	546,468	33.4
		Yenikoy, 1973	6,400	20	20	1,740	9,061,449	31.4
		Total Turkey		625	713	52,873	496,159,608	
UNITED KINGDOM	AMOCO	• Montrose, 1969	8,200	15	21	9,845	78,284,350	40.5
		• N.W. Hutton, 1975	12,000	26	35	30,396	92,242,161	36.0
	ARCO	Thames, 1973	7,892	6	7	180	168,000	48.8
	BP	Beatrice, 1976	6,750	27	39	30,580	100,350,000	38.4
		• Buchan, 1974	8,700	9	9	21,000	66,828,730	33.0
		Clyde, 1978	12,400	10	30	51,443	30,748,221	38.1
		Deveron, 1972	9,000	3	3	4,931	9,964,220	38.2
		East Midlands, 1939	3,500	65	132	1,098	23,656,869	46.0
		• Forties, 1970	7,000	79	103	290,005	1,909,000,000	37.0
		Kimmeridge, 1959	1,705	1	1	78	2,848,085	40.0
		• Magnus, 1974	9,500	11	11	140,830	1,244,300,000	39.0
		Nettleham, 1983	8,850	1	2	430	491,400	35.0
		Stainton, 1984	5,200	1	3	54	60,539	
		Scampton, 1985	5,360		3	10	30,367	
		Thistle, 1973	9,000	33	52	52,177	335,372,988	38.0
		Welton, 1981	5,000			2,390	2,473,794	36.0
		Wytch Farm Bridport Sand, 1974	3,031	10	16	2,915	9,357,081	37.0
		Wytch Farm Sherwood Sandstone, 1978	5,198	5	5	7,165	7,897,508	37.9
	CHEVRON	• Ninian, 1974	10,000	69	103	141,773	811,630,963	35.0
	CONOCO	• Dunlin, 1973	9,100	26	33	52,466	272,071,000	36.0
		• Hutton, 1973	10,000	19	28	63,012	102,373,294	33.0
		• Murchison, 1975	9,900	14	22	45,981	202,267,164	38.0
		• Statfjord, 1974	9,500	9	14	112,745	234,706,984	39.0
	HAMILTON BROS. OIL & GAS LTD.	• Argyll, 1971	9,000-9,400	7	7	7,551	66,116,334	38.0
		• Duncan, 1980	9,600-10,000	3	3	2,717	17,451,521	36.0
		• Innes, 1983	12,300-12,600	2	2	1,846	5,006,437	45.0
	MARATHON	• South Brae Crude Oil, 1975	12,700-13,437	16	27	91,164	175,283,680	35.0
		• North Brae Condensate, 1975	11,900-12,475	7	10	30,537	11,176,875	45.0
	MOBIL	• Beryl, 1972	9,900-11,500	42	61	99,006	391,470,893	37.4
		• Nevis, 1986	9,900-10,112	2	3	16,369	8,228,182	37.5
	OCCIDENTAL	• Claymore, 1974	8,100	*27	28	68,151	322,992,075	30.1
		• Piper, 1973	8,100	*26	25	113,088	830,730,000	37.0
		• Tiffany, 1981	8,100	*4	4	25,675	16,955,490	32.0
	SHELL	• Auk, 1971		9	11	9,840	80,601,000	38.0
		• Brent, 1971		84	130	334,970	1,182,899,000	40.0
		• Cormorant North, 1974		13	28	86,000	186,276,000	34.9
		• Cormorant S. & C., 1972		17	37	122,400	143,698,000	36.0
		• Dunlin A, 1973		26	40	49,180	268,100,000	36.0
		Eider, 1976				2,730	999,000	34.0
		• Fulmar, 1975		13	28	152,380	319,171,000	40.0
	PHILLIPS	• Maureen, 1973	8,000-8,700	3	12	56,821	135,832,613	35.9
	TEXACO NORTH SEA	• Highlander, 1976	8,759-9,372	4	6	13,330	32,564,968	34.0-37.0
		• Petronella, 1975	8,110	1	1	7,080	6,620,774	40.1
		• Tartan, 1974	10,217-12,614	7	16	16,071	66,473,490	37.0-42.0
	TOTAL OIL MARINE	• Alwyn North, 1976	10,170-11,185	10	28	74,690	26,011,000	40.0-41.0
*Number of wells producing before system shut down in July 1988.	UNOCAL	• Heather, 1973	10,800	29	40	14,417	79,579,307	34.3
		Total United Kingdom		755	1,219	2,457,517	8,920,251,377	
YEMEN, NORTH	HUNT OIL	Alif, 1984	6,760	47	56	145,000	62,509,000	40.0
		Azal, 1987	6,850	11	12	14,000	5,143,000	40.0
		Jabal Nuqum, 1988	3,780	1	1	13	5,000	44.0
		Sat Ben The Yazen, 1988	7,600	1	1	3	1,000	40.0
		Total North Yemen		60	70	159,016	67,658,000	
VENEZUELA	PDVSA/ZULIA	Alturitas		5	14	2,025	2,426,806	
		Bachaquero, 1930	10,720	2,332	4,826	148,008	5,195,115,462	23.2
		Boscan, 1946	9,708	95	478	28,171	740,411,326	10.4
		Cabimas, 1917	2,200	635	1,246	52,317	488,083,404	22.8
		Centro, 1959	9,600-11,000	224	242	140,840	890,046,567	36.2
		Ceuta	16,380	109	179	57,524	467,767,396	30.6
		Cruces-Manueles, 1916	4,000-8,000	51	133	4,860	174,890,768	39.2
		La Concepcion, 1953	3,148-8,000	31	162	3,519	137,539,434	34.5
		La Paz, 1925	4,268-8,000	54	154	10,239	858,815,430	30.6
		Lago, 1959	11,450	30	66	14,237	1,705,670,444	32.0
		Lagunillas, 1926	3,000	3,204	5,248	364,373	3,944,381,124	25.7
		Lama, 1957	8,320	257	406	134,626	2,497,044,571	32.5
		Lamar, 1958	13,000	108	182	65,769	213,068,990	35.5
		Mara, 1945	5,240	37	105	8,084	409,148,627	24.0

WORLDWIDE PRODUCTION

	Name of field, discovery date	Depth, ft	No. of wells: Producing	No. of wells: Total	Production: 1988 average B/d	Production: Cumulative to Dec. 31, 1988 Bbl	API gravity
	Mene Grande, 1914	1,150	120	580	2,700	634,647,000	18.4
	Motatan, 1952		60	61	30,700	415,677,000	20.2
	Silvestre, 1948	1,640	1	1	60	11,479,000	30.8
	Tia Juana, 1928	1,970	1,210	1,364	206,300	1,200,453,000	18.7
	Urdaneta, 1977	1,800	100	103	36,400	137,537,000	19.7
	West Tarra, 1942	1,950	1,500	14	11	2,900	42,774,000	19.2
	Other			24	27	10,140	134,552,000	
PDVSA ANZOATEGUI	Aguasay, 1957	2,000	4	6	1			23.4
	Anaco	2,500	43	134	4,100	4,161,917		33.2
	Bare	2,100	15	18	11,000	14,365,000		30.3
	Boca, 1971	3,400	1	4	1,000	1,200,000		32.2
	Cano Seco, 1940	6,200	1,200	11	106	19	3,816,000	33.1
	Oficina, 1934	7,000	1,000	33	34	2,511	394,771,000	34.6
	Dacion, 1957		4,700	44	11	2,500	36,672,000	21.8
	El Roble, 1939	1,500	1,600	17	55	1,600	33,774,000	30.2
	El Tigre		2,800	29	35	7,600	31,128,000	32.1
	Elias, 1954	2,000	3,470	30	104	33	377,754,000	33.5
	Guara, 1936	6,000	6,000	34	113	30,000	1,240,000,000	29.7
	Guara, 1940		1,400	14	60	3,000	19,000,000	21.8
	Jobo, 1938		2,200	17	18	500	7,000,000	19.7
	Leona, 1954			4	13	1,400	9,000,000	33.5
	La Ceiba, 1936		1,200	14	30	2,400	34,447,000	20.1
	La Ceiba, 1963		1,500	13	17	1,400	20,000,000	21.8
	Leona, 1938		1,400	14	60	1,400	15,000,000	19.7
	Mata, 1954	2,400	3,500	31	104	11,000	100,000,000	30.3
	Merey, 1937	4,200	5,000	144	1,000	500	10,000,000	22.4
	Nipa, 1945	3,000	4,000	63	97	4,000	34,000,000	34.6
	Oficina, 1937		5,000	57	100	2,100	181,000,000	22.6
	Oficina Norte, 1962		1,100	14	17	1,400	4,000,000	21.8
	Pato Este, 1968			1	1	60	700,000	31.1
	San Joaquin, 1949		2,000	13	18	11	120,000,000	34.6
	Soto, 1961		1,000	14	40	1,000	10,000,000	31.4
	Sta Ana, 1936		2,000	52	118	2,200	122,000,000	32.1
	Sta Rosa, 1941		2,000	23	31	1,600	43,000,000	30.3
	Yopales, 1947		3,000	36	61	4,700	150,000,000	21.8
	Zapatos, 1958		1,200	17	21	1,200	4,000,000	31.1
	Zapatos, 1959		1,000	11	16	1,000	20,000,000	30.3
	Zuro, 1953		1,000	15	18	1,000	20,000,000	30.3
	Zuro, 1963		500	8	11	500	1,000,000	31.1
	Zuro, 1964		1,400	14	40	1,000	20,000,000	30.3
	Other			84	113	700	12,000,000	
PDVSA MONAGAS	Acema, 1940			11	11	2,000	3,000,000	34
	Acema Norte	3,400		5	64	1,000	4,000,000	31
	Agostay Norte, 1957	3,400		14	36	1,000	1,000,000	30.3
	Cerro Negro			12	36	1,000	1,000,000	34.6
	Furrial, 1960			5	15	10,000	5,000,000	30.3
	Jobo, 1956	11,000	9,000	73	137	30,000	750,000,000	31.1
	Mata Acema, 1971			8	11	1,000	1,000,000	31
	Musipan, 1958		1,000	11	13	1,000	1,000,000	34
	Quiamare, 1971		2,000	14	16	1,000	10,000,000	31.1
	Orocual, 1961		1,000	11	16	1,000	10,000,000	34.1
	Orocual Norte, 1963			11	13	1,000	10,000,000	34.6
	Orocual, 1972		11	11	11	1,000	5,000,000	31.1
	Pilon, 1957			58	104	10,000	150,000,000	31.1
	Punta, 1958	10,000		8	12	1,000	5,000,000	31.1
	Quiamare, 1976	11,000	12,000	11	13	1,000	10,000,000	31.1
	Sta Barbara, 1941	10,000	8,000	8	14	700	100,000,000	31
	Tacat, 1955	11,000	9,000		11	1,000	10,000,000	34.1
	Temblador, 1939	3,000	4,000	19	31	500	200,000,000	34.1
	Agostay, 1957	4,200	4,000	8	11	1,000	40,000,000	31.1
	Carito, 1984					100	1,000,000	31.1
	Carito, 1988					1,000	1,000,000	
	Other			13	17	900	11,000,000	
PDVSA BARINAS	Hato, 1965		1,000	11	18	1,000	11,000,000	31.1
	Madera, 1957		1,000	13	15	500	10,000,000	30.3
	Paez, 1963			17	50	1,000	50,000,000	34.6
	Silvan, 1949		11,000	13	19	1,000	10,000,000	30.3
	Silvestre, 1948		8,000	15	18	1,000	100,000,000	34.6
	Sirsa, 1963	8,000	9,000	11	42	1,000	20,000,000	31.1
	Guafita, 1984			10	18	10,000	50,000,000	34.6
	La Victoria, 1987			1	1	1,000	1,000,000	31.1
	Other			11	11	400	10,000,000	34.6
PDVSA GUARICO	Ranzo, 1959			1	1	100	1,000,000	34.6
	Bella Vista, 1952			10	44	1,000	10,000,000	31.1
	Budare, 1958		4,000	15	31	1,000	50,000,000	34.6
	Jobal, 1960			6	11	100	1,000,000	30.3
	Las Mercedes, 1941		3,000		1,041		41,000,000	22.4
	Roz, 1949		4,000		42		40,000,000	34.6
	Saban, 1947			13	31	700	10,000,000	31.1
	Other			11	14	1,000		
PDVSA AMACURO	Tucupita, 1945				48		6,000,000	34.6

WORLDWIDE PRODUCTION

		Name of field, discovery date	Depth, ft	No. of wells Producing	No. of wells Total	Production 1988 average B/d	Production Cumulative to Dec. 31, 1988 Bbl	API gravity
	PDVSA FALCON							
		Total Venezuela		12,857	26,481	1,730,751	36,937,210,057	
WEST GERMANY	BEB							
	DST							
	MOBIL ERDGAS ERDOL GMBH (MEEG)							
	RWE DEA A.G. Aktiengesellschaft für Mineraloel und Chemie							
	WINTERSHALL A.G.							

WORLDWIDE PRODUCTION

		Name of field, discovery date	Depth, ft	No. of wells: Producing	No. of wells: Total	Production: 1988 average B/d	Production: Cumulative to Dec. 31, 1988 Bbl	°API gravity
		Hauerz, 1985	8,639	1	1	156	251,379	40.4
		Kirchdorf, 1982	5,737	1	1	11	56,660	38.5
		Landau, 1955	4,936	77	81	1,258	27,096,513	36.9
		Maximiliansau, 1959	2,100–5,963				14,587	41.0
		Werkelfeld, 1964	4,596	17	28	298	14,026,666	37.5
		Moenchhof, 1958	5,248	14	23	297	15,571,258	38.1
		Nienhagen, 1925	3,729	12	12	69	10,321,998	30.0
		Oberschwarzach, 1978	4,900	1	1	141	663,225	37.7
		Pattensen, 1954	3,765	6	7	55	1,058,857	29.3
		Rheinzabern, 1959	3,750–5,576	1	1		37,041	37.9
		Ruehlertwist, 1949	3,350–3,900	71	135	1,631	31,884,723	25.0
		Ruelzheim, 1984	7,544	1	1		40,814	37.7
		Schwabmuenchen, 1976	2,438	1	1		34,494	25.3
		Schwedeneck, 1956	5,140	13	30	148	5,211,471	37.5
		Wahlingen, 1939	2,624	1	9	22	1,414,300	30.0
	OTHER OPERATORS[e]	Scheerhorn, 1949	3,550–3,750					30.0
		Rethbrook, 1937	2,450–2,700					29.0
		Oelheim Sued, 1968	7,450	930	1,640	10,000	279,600,000	33.0
		Sinstorf, 1960	6,750–7,250					
		Vorhop, 1952	2,950–6,900					36.0
		Total West Germany		2,917	5,216	77,775	1,565,801,061	
YEMEN, NORTH	HUNT OIL	Alif, 1984	5,700	12	79	18,800	9,514,000	40.0
		Aza, 1987	6,850		6			40.0
		Total North Yemen		12	85	18,800	9,514,000	
YUGOSLAVIA	INA-NAFTAPLIN	Benicanci, 1966	6,752–9,938	29	72	4,641	104,233,394	40.2
		Bokota, 1968	4,346–5,643	43	46	892	8,794,416	42.8
		Bokic-Kiskunhat, 1979	7,218–10,171	11	19	183	1,380	41.1
		Bunjer, 1951	2,900–3,550	17	18	74	1,849,740	40.2
		Crnac, 1977	4,614–5,061	1	1	44	4,347	44.6
		Dugo Selo, 1953	3,335–4,265	13	25	401	4,613,940	41.1
		Deanovac, 1982	3,143–3,412	31	34	1,115	4,756,414	39.4
		Ferdinandovac, 1959	3,625–5,415	5	6	126	1,144,546	46.0
		Jazo, 1985	3,335–3,855	4	10	54	1,000,114	41.0
		Kalinovac, 1959	5,462–5,704	36	40	2,348	41,974,414	41.4
		Kapelchak, 1961	7,864–8,530	30	30	1,078	9,026,262	43.1
		Lukarisce, 1965	6,496–9,022	44	51	2,511	17,054,998	37.4
		Molve, 1965	6,234–7,585	8	8	1,113	9,616,111	46.1
		Okoli, 1953	6,234–7,349	74	102	1,476	41,000,417	44.1
		Kapelica, 1977	3,281–3,609	14	17	479	142,758	39.6
		Kric, 1948	1,600–3,250	41	51	1,000	9,401,436	41.1
		Kalinovac-Kapelica, 1973	6,562–7,218	12	14	2,140	988,000	39.6
		Lipik, 1979	8,497–8,727	1	1	147	1,022,114	39.6
		Lipovljani, 1963	3,281–3,937	1	1	151	1,321,558	39.6
		Lipovac, 1960	3,937–6,004	42	44	1,116	11,478,000	39.6
		Lipovac, 1971	6,562–6,890	1	1	1,000	1,000,000	39.6
		Mihovljan, 1975	5,250–5,906	1	1	1,000	1,000,000	39.6
		Molve Istok, 1949	5,479–8,202	11	14	1,000	2,921,750	39.6
		Okoli, 1967	6,178–7,546	1	1	1,000	1,000,000	39.6
		Okoli, 1962	7,546–8,364	1	1	1,000	1,000,000	39.6
		Pavlovac, 1953	7,415–7,741	1	1	40	1,000,000	39.6
		Struzec, 1976	7,874–8,727	11	11	1,000	11,000,000	39.6
		Sandrovac, 1962	5,250–5,906	14	14	1,000	10,000,000	39.6
		Stevkovica, 1978	7,546–7,643	11	11	1,000	11,000,000	39.6
		Vezisce, 1965	6,719–6,760	1	1	1,000	1,000,000	39.6
		Zdenci, 1963	5,741–6,463	13	14	1,000	10,000,000	39.6
		Kalinovac, 1978	13,841–14,665	11	11	1,000	11,000,000	39.6
		Molve, 1974	13,943–13,943	11	11	1,000	11,000,000	39.6
		Okoli, 1961	7,218–7,874	11	11	1,000	11,000,000	39.6
		Ozlje	5,250–11,800	1	1	1,000	1,000,000	39.6
	OTHER OPERATORS[e]	All fields				10,000	100,000,000	
		Total Yugoslavia		1,032	1,532	73,967	643,553,348	
ZAIRE	CHEVRON	• Kolo, 1970	7,000–9,000	1	1	1,000	6,000,000	38.0
		• Libala, 1981	9,500					33.0
		• Lukanu, 1953	8,000–12,400	4	4	1,000	6,000,000	33.0
		• Mibale, 1973	9,000–9,000	4	4	1,000	10,000,000	33.0
		• Mutuba, 1976	11,000	1	1	1,000	1,000,000	33.0
		• Mwambe, 1979	6,150	1	1	1,000	1,000,000	29.0
	ZAIREP (FINA)	East Mibale, 1978	9,000				1,000,000	33.0
		Kituku, 1983	3,430	1	1	50	50,000	33.0
		Kokozo, 1972	3,500	11	11	1,000	5,000,000	33.0
		Luwenda, 1972	3,430	11	11	1,000	11,000,000	33.0
		Makenkese, 1981	3,600	1	1	1,000	1,000,000	33.0
		Muanda, 1972	3,600	1	1	1,000	1,000,000	33.0
		Nsiantoko, 1977	8,500					33.0
		Tshiende, 1978	3,430	1	1	1,000	1,000,000	33.0
		Total Zaire		107	130	29,150	119,286,108	

Table 1

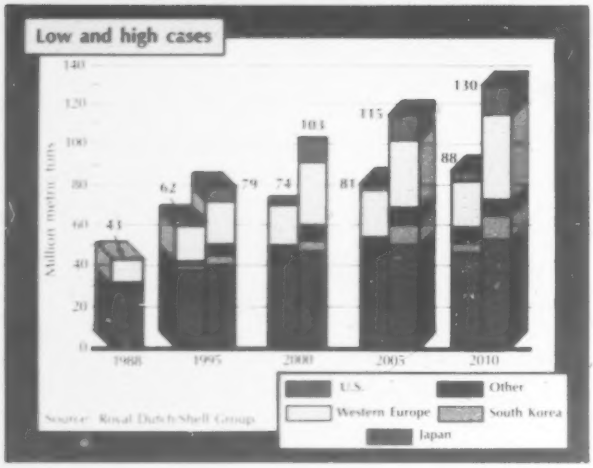
Operational base load LNG export projects*

Exporter	Plant	Importer	Terminal	(Billion cu m year gas)	Term (years)	First deliv ery
Sonatrach Algeria	Camel Skikda Bethioua	Gaz de France France	LeHavre Fos-sur-Mer Montoir	9 1 (toial)	25 25 20	1965 1973 1981
Sirte Oil Co Libya	Marsa El Brega	Enagas Spain	Barcelona	1 1	†20	1971
Phillips-Marathon	Kenai Alaska	Tokyo EP§ Tokyo Gas Japan	Negishi	1 3	†20	1969
Brunei Cold Gas Trading Sdn Bhd Brunei	Lumut	Tokyo EP Tokyo Gas Osaka Gas Japan	Negishi Sodegaura Senboku 1	6 3	20	1972
Abu Dhabi Gas Lique-faction Co Abu Dhabi	Das Island	Tokyo EP Japan	Sodegaura	2 6	20	1977
Pertamina Indonesia	Bontang (PT Badak)	Osaka Gas Chubu EP Kansai EP Japan	Senboku 2 Chita Himeji	9 2	20	1977
Pertamina Indonesia	Lho Seumawe (PT Arun)	Kyushu EP Nippon Steel Japan	Tobata	9 2	20	1978
Sonatrach Algeria	Skikda Camel	Enagas Spain	Barcelona Cartagena Huelva	3 1 (average)	26	1978
Sonatrach Algeria	Bethioua Belgium	Distrigaz Belgium	Zeebrugge	5 0	20	1982
Malaysia LNG Sdn Bhd Malaysia	Bintulu	Tokyo EP Tokyo Gas Japan	Sodegaura Hagishi-Ohgishima Futtsu	7 4	20	1983
Pertamina Indonesia	Bontang (PT Badak)	Chubu EP Kansai EP Osaka Gas Toho Gas Japan	Chita Himeji Senboku 2	3 9	20	1983
Pertamina Indonesia	Lho Seumawe (PT Arun)	Tokyo EP Tohoku EP Japan	Sodegaura Hagashi-Niigata	4 0	20	1984
Pertamina Indonesia	Bontang (PT Badak)	Chubu EP Kansai EP Kyushu EP Chita Japan	Himeji Tobata	0 8	15	1983
Sontrading Sonatrach Algeria	Bethioua	Pan National Gas Sales Inc U S	Lake Charles La	4 3	20	1981
Pertamina Indonesia Nusantara Gas Serv Co Japan	Lho Seumawe (PT Arun) Bontang (PT Badak)	Chubu EP Japan	Yokkaichi	2 54	4	1987
Pertamina Indonesia	Lho Seumawe (PT Arun)	Korea Gas Corp Korea	Pyeong Taek	2 4	20	1986
Sonatrading Sonatrach Algeria	Bethioua	Distrigas Corp U S	Everett Mass	1 17	15	1978

*As of May 1, 1989 †Extended 15 years §Electric Power Co Inc

Source: Institute of Gas Technology

How LNG demand could grow 1



project.

A second tanker, Northwest Swift, was scheduled to go into LNG service in September 1989. The project's third, fourth, and fifth tankers were under construction in Japan and scheduled for delivery in November 1989, September 1990, and September 1991.

By the mid-1990s, when LNG shipments to Japan are to reach a plateau of 6 million metric tons year, Northwest Sanderling and six sister ships will be arriving at the Burrup Peninsula at the rate of two a week. Northwest Sanderling's companion vessels will further swell the world fleet of LNG tankers, which numbered 65 in a census conducted in 1989 by E.A. Gibson Shipwise Ltd., London (Table 2).

Gas production to feed the project moves by pipeline from Platform A in North Rankin field off Western Australia.

The Woodside group decided in 1989 to proceed with the $1.6 billion (Australian) development of Goodwyn gas condensate field, 22 miles southwest of North Rankin. A 30 in. pipeline will connect Goodwyn with North Rankin Platform A. Production was scheduled to start in 1993.

The Woodside joint venture will deliver its 6 million metric tons year of LNG—15% of Japan's total LNG imports—under a 20 year contract to eight Japanese utilities: Tokyo Electric Power Co. Inc., Chubu Electric Power Co. Inc., Kansai Electric Power Co. Inc., Chugoku Electric Power Co. Inc., Kyushu Electric Power Co. Inc., Tokyo Gas Co. Ltd., Osaka Gas Co. Ltd., and Toho Gas Co. Ltd.

The project required a long time to take shape. The original memorandum of understanding was signed in 1981.

Northwest Shelf LNG price is indexed to an average of the fob price of most other LNG shipments to Japan, with a price redeterminer effective generally every quarter. Additions to liquefaction capacity at the plant are expected to track growth in Japanese demand for LNG under take or pay contracts with the end users.

Equal partners with Woodside, BHP, and Shell in the LNG phase of the Northwest Shelf Project are BP Developments Australia Ltd., Chevron Asiatic Ltd., and Japan Australia LNG (MIMI) Pty. Ltd., a joint venture of Japan's Mitsubishi Corp. and Mitsui & Co. Ltd.

Main contractor for the LNG plant was KJK, a combine of M.W. Kellogg Co., JGC Corp., and Kaiser Engineers Australia Pty. Ltd.

The working interest partners were seeking more LNG markets in 1989, mainly in Taiwan and Korea. A long term potential market could be the U.S. West Coast, but there were no efforts under way to pursue U.S. LNG markets.

In December 1989, West Australian Petroleum Ltd., citing "spectacular" growth in Pacific Rim LNG demand, unveiled a project to export LNG to Japan from Gorgon and West Tryall Rocks fields on the Northwest Shelf by the late 1990s.

The company expects LNG demand in Japan, Taiwan, and South Korea to climb to 80 million metric tons year by 2005.

Plans advancing for Nigerian operation

Late in 1989, Nigeria LNG Ltd. let contract to a combine of Technip and M.W. Kellogg Co. for project specification preparation for an LNG plant at Finima, Rivers State, Nigeria.

Nigeria LNG, a four company venture, plans a two train, $2.5 billion plant able to produce about 4 million metric tons year of LNG for export to Europe and the U.S. East Coast starting in 1995. Nigeria estimated LNG exports will reach 5.5 million metric tons year by 1997.

The contract awarded to Technip-Kellogg was scheduled to require 1 year to complete. It calls for provision of comprehensive information on the scope of the plant and the basis on which selected main contractors are to prepare lump sum turnkey proposals for detailed engineering, procurement, and construction.

The project specification will incorporate Shell's design and operating philosophy and practices, as well as its experience in participation in the Brunei, Malaysia, and Northwest Shelf LNG export projects.

Partners in the venture are Nigerian National Petroleum Corp. (NNPC) 60%, Shell Gas BV 20%, and Agip SpA and Ste. Nationale Elf Aquitaine 10% each. Shell Gas Nigeria BV, which had been acting as technical leader for the project, will continue to provide technical and commercial advice and services to the joint venture.

The joint venture will be responsible for all aspects of the project from acquiring gas from NNPC-Shell, NNPC-Agip-Phillips, and NNPC-Elf producing groups, construction and operation of the liquefaction plant, to LNG shipments and sales.

The plant is to use the Technip-Snamprogetti SpA Tealarc liquefaction process.

Nigeria earlier reaffirmed its commitment to the venture with a 5-10 year tax holiday and other incentives.

Algerian policy: Push LNG exports

Algeria, the pioneer in LNG, is taking a more dynamic attitude to gas exports.

Long running disputes with its European customers have been ended, and Algeria's state owned Sonatrach took an equity position in Panhandle Eastern, which eventually led to resumption of LNG exports to the U.S.

Algeria's more flexible attitude to pricing led to first spot LNG sales to Japan and resumption of short term LNG deliveries to the U.K., where imported gas is used for peak shaving.

Algeria also signed export contracts with Botas, Turkey's state oil and gas company, which should see deliveries of as much as 1.52 million metric tons start in 1990-91. A slightly larger contract with Greece for 1.9 million tons is to get under way in 1991.

These small deals plus short term and spot contracts still leave Algeria with a large surplus of liquefaction capacity. Sonatrach wants to revamp the old capacity and possibly build a new unit in preparation for additional contracts with Europe and the U.S.

One of the more significant moves in this strategy was Sonatrach's cooperation agreement with Royal Dutch Shell, which centers mainly on the gas industry.

The agreement was signed after Royal Dutch Shell, in partnership with Columbia Gas, had started detailed negotiations of a 20 year contract for the purchase of 232 MMcfd

Table 2

The world's fleet of LNG tankers as of July 1, 1989

Vessel name	Capacity (cu m)	Flag	Parent owner	Built	Shipyard	Length overall	Beam (m)	Draft	Dwt	Tanks
Methane Princess	27.400	BR	British Gas Corp	1964	Vickers	189.28	24.92	10.70	24.608	9
Havfru	29.388	NO	Havtor	1973	Moss Rosenberg	181.55	29.00	9.42	22.041	4
Century	29.588	NO	Havtor	1974	Moss Rosenberg	181.55	29.06	9.42	22.040	4
Annabella	35.491	LI	Chemikalien Seetrans	1974	Du Nord	198.54	26.50	10.92	25.800	5
Isabella	35.491	LI	Chemikalien Seetrans	1975	Du Nord	198.54	26.50	10.92	27.300	5
Laieta	39.782	SP	Maritima Del Norte	1970	Astano	207.67	29.26	8.69	25.293	4
Tellier	40.081	FR	Cie Gen Maritime	1973	Du Nord	196.80	29.24	8.11	20.579	5
Hassi R Mel	40.109	AG	S N T M Hyproc	1971	Du Nord	199.55	29.32	9.30	21.945	6
Snam Elba	41.005	IT	Agip	1970	Fincantieri	207.87	29.29	8.71	25.397	4
Snam Palmaria	41.005	IT	Agip	1969	Fincantieri	207.87	29.29	8.71	25.397	4
Descartes	50.240	FR	Gazocean	1971	Atlantique	219.79	31.88	8.44	32.634	6
Arctic Tokyo	71.500	LI	Arctic LNG Trans Co	1969	Kockums	243.34	34.04	10.37	32.878	6
Polar Alaska	71.500	LI	Polar LNG Shpg	1969	Kockums	243.34	34.04	10.00	32.878	6
Belanak	75.000	B	Brunei Shell Tankers	1975	Du Nord	257.23	34.80	9.45	51.579	5
Belais	75.040	B	Brunei Shell Tankers	1974	Atlantique	259.75	34.75	11.52	35.847	5
Bebatik	75.056	B	Brunei Shell Tankers	1972	Atlantique	259.75	34.75	11.55	35.847	5
Bekulan	75.072	B	Brunei Shell Tankers	1973	Atlantique	259.75	34.75	11.52	38.046	5
Bekalang	75.078	B	Brunei Shell Tankers	1973	Atlantique	259.75	34.75	11.53	35.847	5
Bubuk	77.679	B	Brunei Shell Tankers	1975	Du Nord	259.75	34.75	10.02	41.369	5
Bilis	77.731	B	Brunei Shell Tankers	1975	Du Nord	259.75	34.75	9.45	42.034	5
Norman Lady	87.994	LI	Coroman Co	1973	Moss Rosenberg	249.56	40.00	10.64	50.922	5
Asake Maru	88.052	JA	Mitsui O S K	1974	Moss Rosenberg	261.55	40.00	10.64	50.746	5
Gastor	122.255	PA	Nedlloyd Group	1976	Atlantique	275.00	42.09	12.30	61.000	6
Nestor	122.255	BR	Ocean Trans & Trad	1977	Atlantique	275.00	42.09	12.30	78.400	6
Northwest Sanderling	125.000	AU	Shell-BHP	1989	Mitsubishi	259.00	47.20	11.95	62.500	4
Kotowaka Maru	125.199	JA	N Y K	1984	Kawasaki	281.00	44.20	11.52	70.833	5
Mostefa Ben Boulaid	125.260	AG	S N T M Hyproc	1976	Du Nord	278.81	40.99	12.20	67.170	6
Senshu Maru	125.556	JA	Mitsui O S K	1984	Mitsui	283.01	44.81	11.50	69.594	5
Echigo Maru	125.568	JA	N Y K	1983	Mitsubishi	283.00	44.81	11.50	67.219	5
Wakaba Maru	125.568	JA	Mitsui O S K	1985	Mitsui	283.01	44.81	11.50	69.846	5
Bishu Maru	125.660	JA	Kawasaki Kisen	1983	Kawasaki	281.00	44.20	11.52	70.546	5
Golar Freeze	125.862	LI	Gotaas-Larsen	1977	H D W	287.55	43.44	11.52	71.620	5
Hoegh Gandria	125.904	NO	Hoegh, Leif	1977	H D W	287.55	43.40	11.52	71.630	5
Mourad Didouche	126.190	AG	S N T M Hyproc	1980	Atlantique	274.43	42.04	13.30	83.020	5
Ramdane Abane	126.190	AG	S N T M Hyproc	1981	Atlantique	274.43	42.04	13.30	83.228	5
Gimi	126.224	LI	Gotaas-Larsen	1976	Moss Rosenberg	293.74	41.60	11.73	72.703	6
Khannur	126.224	LI	Gotaas-Larsen	1977	Moss Rosenberg	293.74	41.60	11.73	72.703	6
Hilli	126.277	LI	Gotaas-Larsen	1975	Moss Rosenberg	293.75	41.60	11.73	72.703	6
Arzew	126.540	AM	Gen Marine	1978	Newport News	289.10	42.69	10.98	63.460	6
Gamma	126.540	AM	Gen Marine	1979	Newport News	289.10	42.69	10.98	63.460	6
Southern	126.540	AM	Gen Marine	1978	Newport News	289.10	42.69	10.98	75.171	6
Lake Charles	126.750	AM	Lachmar Corp	1980	General Dynam	285.30	45.67	11.00	72.571	5
LNG Aquarius	126.750	AM	Energy Trans Corp	1977	General Dynam	285.30	45.67	11.00	64.620	5
LNG Aries	126.750	AM	Energy Trans Corp	1977	General Dynam	285.30	45.67	11.00	64.620	5
LNG Capricorn	126.750	AM	Energy Trans Corp	1978	General Dynam	285.30	45.67	11.00	64.620	5
LNG Gemini	126.750	AM	Energy Trans Corp	1978	General Dynam	285.30	45.67	11.00	64.620	5
LNG Leo	126.750	AM	Energy Trans Corp	1978	General Dynam	285.30	45.67	11.00	64.620	5
LNG Libra	126.750	AM	Energy Trans Corp	1979	General Dynam	285.30	45.67	11.00	64.620	5
LNG Taurus	126.750	AM	Energy Trans Corp	1979	General Dynam	285.30	45.67	11.00	64.620	5
LNG Virgo	126.750	AM	Energy Trans Corp	1979	General Dynam	285.30	45.67	11.00	64.620	5
Louisiana	126.750	AM	Lachmar Corp	1980	General Dynam	285.30	45.67	11.00	72.751	5
Banshu Maru	126.885	JA	N Y K	1983	Mitsubishi	283.01	44.58	11.50	67.055	5
Dewa Maru	126.975	JA	Kawasaki Kisen	1984	Mitsubishi	283.01	44.58	11.50	67.055	5
Golar Spirit	128.998	LI	Gotaas-Larsen	1981	Kawasaki	289.00	46.60	12.52	80.239	5
Edouard L D	129.444	FR	Louis Dreyfus	1977	Du Nord	280.60	41.64	11.00	67.460	5
Bachir Chihani	129.500	AG	S N T M Hyproc	1979	Du Nord	281.72	41.61	11.33	66.746	5
Larbi Ben M Hidi	129.500	AG	S N T M Hyproc	1977	Du Nord	281.69	41.61	10.79	70.067	5
Tenagu Dua	130.000	MY	Malaysian Inter Shpg	1979	Du Nord	280.60	41.64	11.00	72.083	5
Tenaga Empat	130.000	MY	Malaysian Inter Shpg	1981	Du Nord	280.62	42.00	11.03	72.083	5
Tenaga Lima	130.000	MY	Malaysian Inter Shpg	1981	Du Nord	280.62	42.00	11.03	72.083	5
Tenaga Satu	130.000	MY	Malaysian Inter Shpg	1979	Du Nord	280.60	41.64	11.00	72.083	5
Tenaga Tiga	130.000	MY	Malaysian Inter Shpg	1982	Du Nord	280.60	41.64	11.00	72.083	5
Methania	131.264	BE	C M B	1978	Boelwerf	280.01	41.61	11.22	67.879	5
LNG 559	132.588	BS	Zenit Shipping	1981	Kockums	286.93	41.84	10.70	89.654	5
LNG 564	132.750	SW	Zenit Shipping	1983	Kockums	286.93	41.84	10.70	71.980	5

BR Britain, NO Norway, LI Liberia, SP Spain, FR France, AG Algeria, IT Italy, B Brunei, JA Japan, PA Panama, AU Australia, AM America, MY Malaysia, BE Belgium, BS Bahamas, SW Sweden

Source: E.A. Gibson Shipwise Ltd.

Breakout of U.S. and international E&P outlays

	1989*	1988
	Million U.S. $	
MAJORS		
U.S. SPENDING		
Amoco	1,100	1,539
ARCO	1,500	1,270
British Petroleum	850	408
Chevron	1,100	1,033
DuPont	650	600
Elf Aquitaine	85	150
Exxon	1,400	1,500
Mobil	900	1,114
Occidental	270	327
Oryx	415	382
Pennzoil	164	136
Phillips	424	457
Royal Dutch/Shell	1,974	2,274
Tenneco		350
Texaco	700	420
Total Minatome	70	72
Union Pacific	350	348
Unocal	400	420
USX	800	505
Total	12,575	14,270
Percent change	-11.9	
SELECTED INDEPENDENTS		
U.S. SPENDING		
Adobe Resources	41	34
Amax Oil & Gas	50	54
American Petrofina	71	57
Anadarko	140	210
Apache Corp.	90	70
Arkla	70	55
Berkley Petro	24	24
Burlington Resources	143	134
Cabot	100	81
Cabot Corp.	70	50
Columbia Gas System	200	50
Consolidated Natural Gas		
Coastal	240	195
CRA Energy	50	51
Dekalb	50	50
Diversified Energies	100	45
Energy Corp.	90	70
Enron	192	300
Enserch	83	140
Equitable Resources	60	50
First Energy Corp.	23	23
Forest	75	57
Freeport-McMoRan	150	98
Helmerich & Payne	20	19
Inexco	33	18
Kerr-McGee	130	95
Louisiana L&E	100	130
Maxus	58	99
Mesa	50	43
Mitchell	50	50
Murphy	69	24
National Fuel Gas	39	51
Nerco	20	20
Noble	30	30
Noble	55	66
Norcen	18	19
Nowsco	31	13
Norcen	41	46
ONEX	60	42
Pacific Enterprises	140	140
Petroleum Delaware	10	54
Pogo Prod.	28	19
Presidio	25	6
Questar	24	23
Santa Fe Energy	60	60
Seagull	34	23
Seneca Offshore	5	5
Snyder	55	39
Southdown	16	46
Transco Exp. Partners	40	77
Ultramar plc	24	20
Union Texas	60	14
Wolverine	25	66
Total	3,343	2,297
Percent change	+45.5	
MAJORS SELECTED INDEPENDENTS CANADIAN SPENDING		
Alberta Energy	50	
Amerada Hess	55	100
Amoco	150	140
Anderson Exploration	50	30
Bow Valley	50	100
Canada Northwest	40	55
Canadian Occidental	60	70
Chevron	50	50
DuPont	50	50
Elf Aquitaine	50	50
Enron	50	50
Gulf Canada	200	200
Imperial	300	300
Mark Resources	45	60
Mobil	100	100
Murphy	50	50
Nerco	175	90
Norcen	75	75
North Canadian Oils	55	50
Numac	50	50
PanCanadian	225	225
Panterra Res.	50	50
Placer Dome	125	82
Rigel	47	70
Renaissance Energy	80	65
Seagull	55	45
Shell Canada	250	250
Sonat	50	75
Total	30	30
Ultramar	0	20
Union Pacific	50	28
Unocal	70	60
Total	3,109	3,410
Percent change	-8.8	
MAJORS SELECTED INDEPENDENTS OTHER INTERNATIONAL		
EX-SPENDING		
Agip	1,450	1,400
Amerada Hess	225	160
Amoco	410	750
Ashland	95	71
ARCO	450	450
Bow Valley	40	60
British Gas	340	270
British Petroleum	2,500	2,244
Canada Northwest	15	65
Canadian Occidental	70	17
Chevron	450	500
DuPont	450	575
Elf Aquitaine	1,300	1,300
Enron	10	14
Enserch	100	150
Exxon	1,400	1,500
Gulf Canada	50	50
Gulf Interest	50	50
Hamilton	70	63
Kerr-McGee	82	84
Lasmo	100	73
Louisiana L&E	10	10
Maxus	43	95
Mobil	700	610
Murphy	21	14
Nerco	41	70
Nova Hudd	70	130
Occidental	210	200
Odeco	80	70
Petrofina	70	142
Pennzoil	70	126
Pennzoil Consolidated	60	60
Ranger	14	14
Royal Dutch/Shell	1,800	1,758
Sasol	150	134
Sceptre	200	114
Sun	100	74
Texaco	350	400
Total	600	540
Total	0	30
Ultramar	130	80
Union Texas	60	80
Unocal	250	300
USX	280	300
Total	*20,196	17,478
Percent change	+15.6	

*Salomon Bros. Inc. estimates. Those spending at least $20 million in either year.

Source: Salomon Bros. Inc.

The June 1989 survey also found that 36% of the independents it polled were underspending their U.S. budgets.

Some companies, such as Transco Exploration Co., Union Texas Petroleum Corp., and Wolverine Exploration Co., significantly reduced 1989 U.S. spending plans.

Companies that cut spending plans most often cited skepticism on oil price strength, a lack of good prospects, cash flow constraints, limited outside funds, and diversion of funds to acquisitions.

Seaborne shipping set to rise in 1990s

INDEPENDENT TANKER OWNERS PREDICT RISING volumes of seaborne oil shipments during the 1990s.

The International Association of Independent Tanker Owners (Intertanko), Oslo, bases its prediction on an outlook for increasing oil consumption among industrialized countries.

Coupled with that will be greater calls for oil from members of the Organization of Petroleum Exporting Countries, largely those in the Middle East, as non-OPEC, non-Communist oil supplies falter for lack of enough discoveries to fully replace produced reserves. Increased oil shipments from the Middle East to large importers mean more long hauls for tanker owners.

"The long term prospect for the tanker industry looks promising," Intertanko said in its 1988 annual report.

It predicted world seaborne trade for crude and products will be about 850 billion metric ton miles in 1995, amounting to an increase of about 3.5%/year during the late 1980s to mid-1990s. The volume of seaborne trade historically moves in lockstep with Middle East oil production, which Intertanko predicted will rise to about 18.1 million b/d in 1995 (Fig. 1).

The prediction assumes a growth rate of about 1.4%/year in non-Communist oil demand in the late 1980s to the mid-1990s. So demand in 1995 will be 55.6 million b/d, up from 50.2 million b/d in 1988.

It also assumes that increased demand for oil will be supplied by the Middle East. Non-OPEC, non-Communist oil flow will increase a little early in the period, then falter slightly by 1995. World seaborne oil trade probably will increase slightly less than Middle East production because of increased use of pipelines to the Red and Mediterranean seas and dredging of the Suez Canal.

Productivity of the world tanker fleet is likely to improve due to increased long hauls, increased speed, and better efficiency of newly built vessels, Intertanko said.

Fortunes improve for tanker industry

Figures for 1988, the latest full year for which data were available, showed a sharply improved tanker industry, largely because of surging production by OPEC members.

In fact, Intertanko said, 1988 was the best year for the world tanker industry since 1973-74. Voyage liftings in December 1988 jumped about 20% from the same month in 1987 to reach the highest level of the decade, and tonnage in layup fell sharply during 1988 (Table 1).

Tonnage in layup almost disappeared, falling to only about 3 million dwt, of which six vessels were very large crude carriers (VLCCs). More than 8 million dwt was taken out of layup in 1988.

Tonnage reported as floating storage remained fairly

Table 1

How tankering improved in 1988...

WITH MORE LIFTINGS AND CHARTERS

	1981	1982	1983	1984	1985	1986	1987	1988
December:								
Voyage liftings	31.5	30.3	30.4	29.6	32.4	47.7	42.8	51.1
Unused capacity*	5.5	5.0	4.3	4.4	3.7	5.8	4.9	4.1
Time charter	1.4	0.3	0.1	2.2	0.7	0.5	0.3	3.2
Year to date:								
Voyage liftings	368.6	301.8	359.0	396.8	403.2	476.3	508.9	625.9
Time charter	14.7	4.7	6.0	10.7	12.0	14.2	8.1	21.8

FEWER LAY-UPS...†

	As of Jan. 1, 1988		As of Dec. 1, 1988		As of Jan. 1, 1989	
	Number	Dwt	Number	Dwt	Number	Dwt
Built:						
Before 1970	24	858,303	16	643,966	19	546,702
1970-1974	15	1,886,367	6	592,785	5	571,423
1975	38	8,498,022	14	2,049,437	13	1,896,639
Total	**77**	**11,242,692**	**36**	**3,286,188**	**32**	**3,014,764**
Size:						
10-50,000	36	1,053,537	22	660,279	19	541,653
50-100,000	8	591,776	5	374,433	5	374,433
100-200,000	8	1,242,247	3	448,079	2	295,281
Above 200,000	25	8,355,132	6	1,803,397	6	1,803,397

AND LESS IN FLOATING STORAGE

	As of Dec. 1		As of Jan. 1	
Year	Number	Dwt	Number	Dwt
1984	98	19,414,865	73	13,449,946
1985	93	18,530,876	86	17,847,280
1986	83	17,091,096	78	14,168,976
1987	59	11,970,002	96	20,142,014
1988	61	11,605,739	62	12,606,930
1989	...	...	68	13,540,060

*In the voyage market due to part cargo. †Seven combination carriers totaling 529,654 dwt are included in the figures.

Source: Howard Houlder (Chartering) Ltd. Intertanko

How world surplus tanker capacity shrank*

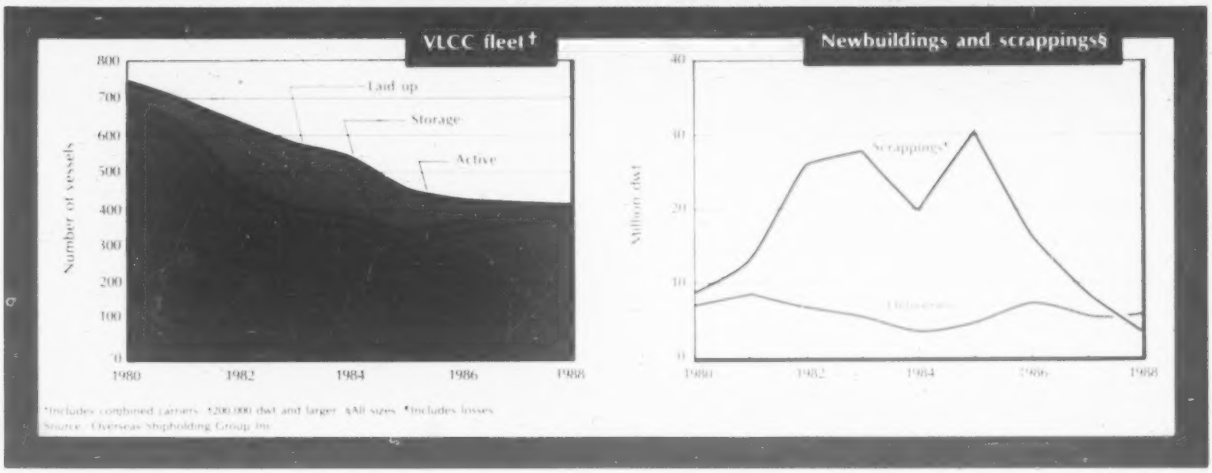


Table 2

Tanker orders*

Shipyard site	1,000 gross tons
Japan	3,622
South Korea	2,451
Yugoslavia	988
Spain	908
Romania†	471
Brazil	426
China†	267
Poland	235
Denmark	172
India	150
Taiwan	93
Italy	41
U.K.	33
Finland	18
West Germany	10
Netherlands	2
Total§	**10,361**

*On order or under construction at the end of second quarter 1989
†Information incomplete. §Does not add because of rounding.

Source: Lloyd's Register of Shipping

He added that Intertanko must take the lead, building on the natural rapprochement that has evolved with oil companies in recent years to achieve a more balanced, if not standard, set of contractual terms.

Japan sets pace in tanker construction

A solid measure of improving economics of the tanker industry was apparent in a sharp jump in worldwide orders for oil tankers in second quarter 1989.

Lloyd's Register of Shipping, London, reported total tonnage of tankers under construction or on order rose by more than 900,000 gross tons to 10.4 million gross tons from the first quarter, with the increase paced by Japan (Table 2).

Tanker orders accounted for almost half of the 2.1 million gross ton increase to 27.3 million gross tons in the world orderbook during second quarter 1989.

The total world orderbook jumped from 24 million gross tons at the end of second quarter 1988 and from 21.3 million tons at the end of second quarter 1987.

Tankers accounted for 37.9% of the total orderbook in the second quarter vs. 28.8% for bulk carriers and 17.8% for general cargo vessels.

Orders placed in the quarter totaled more than 5.2 million gross tons, which topped tonnage completed in the period by more than 2.1 million gross tons.

At the end of second quarter 1989, Japanese yards led the world in total shipping orders with a 30% increase to 7.8 million gross tons from the previous quarter. Oil tankers accounted for 3.6 million gross tons of Japan's total orderbook at the end of the quarter.

Japan also had about 1 million gross tons of liquefied gas carriers and chemical tankers under construction or on order at the end of the second quarter. That was about 70% of the world total.

Japanese completions in the quarter totaled 1 million gross tons. That included the LR class 105,010 gross ton Northwest Sanderling LNG carrier Mitsubishi Heavy Industries built as the first of a fleet of seven for Australia's Northwest Shelf LNG export project.

South Korean shipyards, financially strapped and plagued by strikes, posted an increase of only 33,000 gross tons in their total orderbook for the period, although South Korea's total of 6.5 million gross tons was almost five times more than the next biggest orderbook.

Daewoo Shipbuilding & Heavy Machinery Ltd., Seoul, delivered the biggest vessel built during second quarter 1989, the 276,052 dwt World Prime oil tanker, to World-Wide Shipping Agency Ltd., Hong Kong.

South Korean prices for a VLCC were believed to approach $75 million, Intertanko reported.

Tanker design aims for top efficiency

A subsidiary of Tokyo refiner Toa Oil Co. Ltd. took delivery of a VLCC designed to achieve high speed and save fuel, Oil & Gas Journal reported in February 1989.

Ishikawajima-Harima Heavy Industries Co. Ltd. (IHI), Tokyo, delivered the T.Y. Draco tanker to Toa's Tonen Energy & Marine (Singapore) Pte. Ltd. after 6 months of construction at Kure, Japan. The 236,604 dwt vessel has a new hull form and an improved Grem vane wheel (GVW) system developed jointly by IHI and Lips BV, Drunen, Netherlands. The results:

- A speed about 2 knots faster than VLCCs of convention-

FPSO units on stream or planned worldwide (source SBM, Monaco).

Date	Country	Field	Operator leaseholder	Mooring type	Vessel	Vessel size (000 dwt)	Water depth (m)	Max wave (m)	Process capacity x 1,000 b/d
1977	Spain	astellon	Shell	SALS	tanker	60	117	16	20
1979	Brazil	Garoupa	Petrobras	SALMRA	tanker	55	118	15	50
1980	Italy	Nilde	Agip	SALS	tanker	80	96	19	20
1981	USA	Hondo	Exxon	SALMRA	tanker	50	150	13	37
1981	Phils*	Cadlao	Amoco	SBS	tanker	127	97	17	30
1982	Tun*	Tazerka	Shell	SALS	tanker	210	140	19	30
1983	Brazil	Garoupa	Petrobras	SBS	tanker	55	118	15	50
1985	Egypt	Geisum	Conoco	Spread mooring	tanker	227	45	6	20
1985	Italy	Mila	Montedison	CALM SY	tanker	70	55	14	20
1986	Nig*	Antan	Ashland	Jacket SY	tanker	285	14	10	80
1986	Indo*	Kakap	Marathon	SBS	tanker	140	88	13	22
1986	Indo*	Kepiting	Conoco	Spread mooring	newbuild	11	90	12	10
1986	Aust*	Jabiru	BHP	Turret Disc	tanker	160	120	10	50
1986	China	Weizhou	Total	Tower Hawser	tanker	172	37	small	30
1986	Norway	Petrojarl	Varies	DP Turret	newbuild	52	varies	29	30
1986	Italy	Nilde II	Agip	Turret	tanker	138	96	19	16
1987	Brazil	Albacora	Petrobras	SBS	tanker	55	230	15	50
1989	China	Bohai BZ-28	JCODC BOC	Jacket SY	newbuild	52	23	10	10
1989	Indo*	Anoa	Amoseas	Turret	newbuild	70	77	12	35
1989	Aust*	Challis	BHP	SALMRA	newbuild	115	110	16	120
1990	China	Bohai BZ-34	JCODC BOC	Jacket SY	newbuild	52	20	10	10
1990	China	Huizhou	21-3 ACT	Turret	tanker Disc	250	116	15	130

Key
Aust* Australia
Indo* Indonesia
Nig* Nigeria
Tun* Tunisia
Phils* Philippines

that the technology can be used in depths of over 3,000 ft. Catenary-based systems and especially turrets become more attractive with increasing water depth due to the more favorable restoring force characteristics in deep water.

Storage capacity on FSPO vessels ranges from 300,000 bbls to 2 million bbls. This capacity determines maximum flow rates. Shuttle tanker operations typically require a minimum capacity of 5-10 days production, increasing for remote locations. In most cases, the size of the FPSO is selected to provide the required interval between offloadings at the expected flow rate.

Up to about 100 MMcfd of gas can be handled. Local legislation on long term gas flaring may, in some cases, determine the operational limit, he said.

The biggest operational system is the Antan unit installed 20 miles offshore Calabar, Nigeria by Ashland Oil and Nigerian National Petroleum Co which has a capacity of about 80,000 b/d. The ACT group is currently developing a system for installation on Huizhou, China, which will have a capacity of 130,000 b/d.

Ashland's Nigerian system uses the converted 285,000 dwt tanker Berge Pilot which receives partly stabilized crude from a number of fields which are being exploited with fixed steel drilling platforms carrying first stage oil and gas separation and well test facilities.

The FPSO serves as a center for field operations with production status telemetered from the outlying production platforms to a control room on the vessel. The FPSO was designed, installed and is operated by SBM Inc under lease to Ashland.

Two parallel process trains on the deck are capable of processing 80,000 b/d of crude. The unit has about 1.5 millions bbls of storage.

Stambouzos said during start-up and modifications to instruments there were 24.5 hours downtime. But since then the system has operated continuously and a total of 28 millions bbls of oil have been processed and exported into shuttle tankers in 44 liftings.

He added that although there is no real limit to the number of wells that can be simultaneously produced into a FPSO, there is a practical limit on the number of flexible risers which can be carried, arising from space limitations within the non-weathervaning part of the mooring system. The limit ranges from 20-40 risers including umbilicals, depending on the size of the mooring system and the size of the flexible risers. A turret with a 7 meter diameter slewing roller bearing can accommodate up to 20, 6 in. risers while a turret with a 20 meter diameter slewing bogie arrangement can accommodate up to 40.

FPSO units make for easy changes of production systems during field life and facilitate field decommissioning. The Nilde field offshore Sicily was originally produced by a SALS-moored FPSO based on the converted 84,000 dwt Agip Milano which was installed in August 1980 and continued in service until the summer of 1986 when it was replaced by the larger, turret-moored FPSO Agip Firenze. This unit was recently decommissioned when the field was depleted.

Summarizing operational experience with FPSO's, Stambouzos said in 43 system-years of operational experience, no production shutdown because of vessel motions had been recorded. After the usual commissioning and start-up problems had been corrected, operational uptime exceeded 99.8%.

Single point mooring around the world

Country	Year	Port Field	Owner	Designer Contractor	Max. Vessel Size (Dwt)	Hose number Size System	Water Depth (Ft.)
Angola	1968	Cabinda	Gulf	SBM	100 000	2-16" CALM	77
	1979	Quinfuquena	Petrangol	EMH	150 000	2-16"	NA
	1980	Essungo	Texaco Petrangol	IMODCO	250 000	2-24" & 1-16" CALM	115
	1980	Cabinda	Gulf	SBM	55 000	1-4" CALM	118
	1982	Takula	Gulf	SBM	300 000	1-12" CALM	200
	1985	Takula II	Gulf	SBM	319 000	CALM	72
	1984	Palanca	Elf	SBM	265 000	S-Y CALM	148
	1989	Cabinda	CABCOG	SBM	55 000	LPG CALM	118
	1989	Palanca	Elf	SBM	300 000	Turret Mooring System	140
Argentina	1970	Puerto Rosales	YPF	IMODCO	40 000	1-16" & 1-12" CALM	59
	1975	Caleta Olivia	YPF	IMODCO	60 000	1-20" & 1-12" CALM	113
	1979	Caleta Cordova	YPF	IMODCO	60 000	1-20" & 1-12" CALM	89
	1980	Puerto Rosales	YPF	IMODCO	60 000	1-20" & 1-12" CALM	NA
	1987	Hidra	Total	SBM	N A	CALM	N A
Australia	1970	Botany Bay	Maritime Services	SBM	120 000	3-12" CALM	63
	1985	Jabiru	BHP	SBM	160 000	Turret FPS	394
	1989	Challis	BHP	IMODCO	115 000	SALMRA	393
Bangladesh	1967	Chittagong	Chittagong Port Trust	IMODCO	45 000	1-12" CALM	45
Brazil	1968	Tramandai	Petrobras	SMB	105 000	2-16" CALM	71
	1970	Tramandai	Petrobras	SBM	200 000	1-24" CALM	71
	1975	Garoupa	Perobras	CB & 1	53 000	NA	NA
	1975	Garoupa	Petrobras	CB & 1	53 000	NA	NA
	1976	Sao Francisco	Petrobras	IMODCO	200 000	2-20" CALM	72
	1978	Garoupa	Petrobras	IMODCO	53 000	2-16" CALM	410
	1978	Enchova 4	Petrobras	SBM	53 000	1-8" CALM	410
	1979	Tedut & Tefran	CEC Petrobras	SBM	200 000	2-20" CALM	72
	1980	Arembepe	Tibras	SBM	4 000	1-16" CALM	60
	1981	Pampo	Petrobras	SBM	53 00	1-16" CALM	460
	1981	RJS 28A	Petrobras	SBM	53 000	1-16" CALM	395
	1981	Badejo	Petrobras	IMODCO	53 000	2-10" CALM	338
	1982	Corvina	Petrobras	SBM	53 000	2-8" CALM	492
	1982	Garoupa	Petrobras	Bluewater	100 000	S-Y CALM	
	1983	Garoupa	Petrobras	SBM	55 000	SBS	387
	1986	Albacora	Petrobras	SBM	55 000	SBS	754
	1989	Marim	Petrobras	IMODCO	n.a	CALM	1312
	1989	Marim	Petrobras	IMODCO	n.a	CALM	1312
Brunei	1971	Seria	Shell	SBM	150 000	2-16" CALM	73
	1975	Seria	Shell	SBM	210 000	2-20" CALM	67
	1981	Seria	Shell	Mitsubishi	313 000	1-20" & 1-16" CALM	NA
Cameroon	1976	Kole	Elf Serepca	IMODCO	150 000	1-12" CALM	80
	1979	Kole	Elf Serepca	Bluewater	250 000	1-24" CALM	102
	1979	Limboth Point	Sonara	SBM	150 000	2-16" & 1-16" CALM	75
	1981	Kole	Elf Serepca	IMODCO	250 000	2-24" & 1-16" CALM	85
	1982	Victoria Marine	Total	EMH	280 000	CALM	183
Canada	1969	St. John N B	Irving Oil	SBM	350 000	1-24" & 1-16" CALM	149
	1987	Saint John	Canaport	SBM	N A	CALM	N A
Chile	1971	Quintero Bay	Enap	SBM	209 000	2-20" CALM	164
China	1985	Weitzhou	Total	EMH	250 000	Fix tower	123
	1985	Bohai Bay	JCODC	Bluewater	100 000	FPSO TOWSY	72
	1985	Weitzhou	CSOFL	SBM	250 000	Tank Conv	250
	1988	Block 16 08 S. China Sea	ACT	SBM	250 000	Turret disc	380
	1986	BZ 28-1 Bohai	JCODC	SBM	52 000	SY Jacket	75
	1988	BZ 34-2 Bohai	JCODC	SBM	52 000	SY Jacket	65
China	1988	16 08 South China Sea	ACT	SBM	250 000	Turret Mooring Tanker	381

Single point mooring around the world—*continued*

Country	Year	Port Field	Owner	Designer Contractor	Max. Vessel Size (Dwt)	Hose number Size System	Water Depth (Ft.)
Colombia	1985	Covenas	Occidental	Bluewater	120.000	CALM	80
	1985	Covenas	Occidental	Bluewater	350.000	CALM S-Y	110
Congo	1972	Djeno	Elf Congo	SBM	250.000	2-20" CALM	75
Denmark	1971	Dan	Danbor	SBM	70.000	1-12" CALM	150
	1979	Gorm	Danbor	SBM	70.000	2-12" CALM	128
	1982	Frederickshaven	DDCS	SOFEC	35.000	2-20" CALM	50
Dominican Republic	1971	Santo Domingo	Refineria Domincia	SBM	150.000	2-16" CALM	85
Ecuador	1971	Esmeraldas	Gulf Texaco	SBM	100.000	2-20" CALM	124
	1971	Esmeraldas	Gulf Texaco	SBM	100.000	1-24" & 1-20" CALM	124
	1978	Esmeraldas	Texaco	IMODCO	100.000	1-24" & 1-20" CALM	118
Equatorial Guinea	1963	Bata	CEPSA	IMODCO	20.000	1-16" CALM	39
Egypt	1968	Ras-el-Shaqiq	Wepco	SBM	100.000	2-16" CALM	78
	1974	Suez	Sumed	SBM	120.000	2-20" CALM	82
	1974	Alexandria	Sumed	SBM	120.000	2-20" & 1-16" CALM	85
	1974	Alexandria	Sumed	SBM	120.000	2-20" & 1-16" CALM	82
	1974	Alexandria	Sumed	SBM	120.000	2-20" & 1-16" CALM	82
	1976	Suez	Sumed	IMODCO	250.000	2-24" CALM	80
	1976	Alexandria	Sumed	IMODCO	250.000	2-24" & 1-20" CALM	108
	1976	Alexandria	Sumed	IMODCO	250.000	2-24" & 1-20" CALM	108
	1976	Agami	EGPA	SBM	100.000	2-16" CALM	98
	1978	El Alamein	Wepco	SBM	100.000	2-16" CALM	70
	1980	Ras Budran	Suez Oil Co	SBM	250.000	1-24" & 1-20" CALM	115
	1981	Suez	Sumed	SBM	500.000	2-24" & 1-16" CALM	118
	1982	Sidi Kerir	Sumed	IMODCO	250.000	2-20" & 1-20" CALM	108
	1983	Zeit Bay	SUCO	SBM	155.000	2-20" CALM	82
	1983	Ras Shukeir	EGPC	SBM	100.000	CBM	
	1983	Wadi Feiran	Petrojet	NA	100.000	NA	
	1984	East Zeit Bay	Esso	IMODCO	85.000	CALM	200
	1984	Geisum	Conoco	IMODCO	100.000	ENG FPSO	
	1985	Sadat area	Petrojet	IMODCO	60.000	CBM	60
	1988	Wadi Feran	ENPPI	SBM	3.000	CBM	30
Falklands	1984	Port	M.O.D	IMODCO	45.000	1-10" CALM	65
France	1968	Bay of Biscay	Elf	CFEM	100.000	NA	NA
	1973	Frontignan	Mobil	IMODCO	270.000	2-20" CALM	102
Gabon	1965	Gamba	Shell	SBM	100.000	1-16" CALM	63
	1967	Lucina	Shell	SBM	165.000	1-16" CALM	112
	1979	Gamba	Shell	SBM	140.000	1-16" & 1-10" CALM	63
	1983	Inguessi	AMOCO	Bluewater			
	1980	Mayumba	Elf Gabon	Bluewater	70.000	1-4" CALM	79
Ghana	1978	Bonsu	Agripetco	SOFEC	64.000	1-10" CALM	79
India	1975	Bombay High	ONGC	SBM	100.000	1-16" & 1-8" CALM	240
	1975	Bombay High	ONGC	SBM	100.000	1-16" CALM	240
	1977	Gulf of Kutch	IOC	SBM	300.000	2-24" CALM	115
	1982	Bombay High	ONGC	IMODCO	2.500	SBBM	262
	1983	Bombay High	ONGC	IMODCO	150.000	1-16" CALM	NA

Single point mooring around the world—*continued*

Country	Year	Port Field	Owner	Designer Contractor	Max. Vessel Size (Dwt)	Hose number Size System	Water Depth (Ft.)
	1984	Gulf of Kutch	IOC	IMODCO	100,000	CALM	101
	1985	Panna	ONGC	IMODCO	115,000	CALM	120
	1987	South Bassein	ONGC	SBM	N.A.	2 SVMs	N.A.
	1987	D-18	ONGC	IMODCO	115,000	1-16" CALM	300
Indonesia	1970	Pang Kalan Susu	Pertamina	IMODCO	100,000	2-12" CALM	NA
	1971	Balikappan	Union Oil	SBM	250,000	2-20" & 1-16" CALM	102
	1971	Java Sea	ARCO	McDermott	45,000	1-8"	NA
	1971	Java Sea	IIAPCO	IMODCO	55,000	2-12" CALM	120
	1972	Java Sea	ARCO	IMODCO	133,000	1-12" & 2-16" CALM	135
	1972	Java Sea	IIAPCO	IMODCO	133,000	2-12" & 2-20" CALM	130
	1973	Djatibarang	Pertamina	IMODCO	150,000	3-20" CALM	75
	1973	Ardjuna	ARCO	SBM	150,000	3-16" CALM	138
	1973	Ardjuna	ARCO	SBM	200,000	2-16" CALM	126
	1974	Ardjuna	ARCO	SBM	60,000	SBS	140
	1974	Bekapai	Total	SBM	100,000	2-8" CALM	123
	1975	Poleng	Cities Service	SBM	55,000	2-8" SBS	180
	1976	Handil	Total	SBM	125,000	2-20" CALM	105
	1977	Balongan	Pertamina	SBM	150,000	2-20" & 1-16" CALM	74
	1978	Udang	Conoco	SBM	93,000	2-8" SBS	302
	1980	Cinta	IIAPCO	IMODCO	133,000	2-12" & 2-20" CALM	130
	1980	Semarang	Pertamina	SBM	17,000	1-16" CALM	39
	1981	Krisna	IIAPCO	IMODCO	230,000	2-20", 2-16" & 1-6" CALM	NA
	1981	Ardjuna	ARCO	SBM	56,000	1-6" CALM	135
	1981	NA	LETJES	SOFEC	10,000	2-8"	60
	1981	Balikpapan	Pertamina	SBM	150,000	CALM	102
	1983	Lalang	BP	Bluewater	140,000	Yoke Tower	NA
	1983	Balongan	Pertamina	SBM	35,000	1-16" CALM	46
	1983	Arun	Mobil	Bluewater	100,000	CALM	
	1984	Kakap	Marathon	SBM	140,000	SBS	295
	1985	West Madura	Kodeco	Bluewater	100,000	CALM	330
	1985	Kepiting	Conoco	Comb. Eng.	100,000	FPSO CBM	330
	1989	Anoa	Amoseas		70,000	Turret Mooring Tanker	252
Iran	1970	Cyrus	Ipac	SBM	140,000	2-16" CALM	141
	1971	Iman Hasan	SIRIP	IMODCO Ltd	250,000	2-16" CALM	82
	1983	Iman Hassan	NIOC	SBM	250,000	CALM	160
	1985	Bushire	Smit Tak	SBM	150,000	CALM	118
	1985	Persian Gulf	NIOC	IMODCO Ltd	250,000	2-24" CALM 1-16"	85
	1985	Persian Gulf	NIOC	IMODCO Ltd	250,000	2-24" CALM 1-16"	100
	1985	Persian Gulf	NIOC	IMODCO Ltd	250,000	2-24" CALM 1-16"	94
	1985	Persian Gulf	NIOC	IMODCO Ltd	250,000	2-24" CALM 1-16"	Stored as spare
	1985	Persian Gulf	NIOC	IMODCO Ltd	250,000	2-24" CALM 1-16"	Stored as spare
	1985	Persian Gulf	NIOC	IMODCO Ltd	250,000	2-24" CALM 1-16"	Stored as spare
	1985	Persian Gulf	NIOC	IMODCO Ltd	250,000	2-24" CALM 1-16"	Stored as spare
	1988	Taheri	Smit Tak NIOC	SBM	40,000	CALM	56
Iraq	1981	Arabian Gulf	Brown & Root	IMODCO Ltd	270,000	2-24"	NA
	1981	Arabian Gulf	Brown & Root	IMODCO Ltd	270,000	2-24"	NA
	1981	Arabian Gulf	Brown & Root	SBM	270,000	2-24"	NA
	1981	Arabian Gulf	Brown & Root	SBM	270,000	2-24"	NA

Single point mooring around the world—*continued*

Country	Year	Port Field	Owner	Designer Contractor	Max. Vessel Size (Dwt)	Hose number-Size System	Water Depth (Ft.)
Italy	1963	Fimicino	PURFINA	IMODCO	50,000	2-12" CALM	49
	1963	Ravenna	SAROM	IMODCO	50,000	2-12" CALM	NA
	1964	Fiumicino	PURFINA	Dalmine	100,000	1-16" RMD	NA
	1970	Porto Torres	Sardoil	SBM	255,000	2-20" CALM	101
	1972	Ancona	API	Lavore Adriatica Maritime	300,000	NA	NA
	1972	Genoa	Port Authority	CIDONIO	500,000	2-20" & 2-12"	NA
	1981	Rospo Mare	Elf Italiana	EMH	35,000	2-10"	NA
	1981	Genoa	C A P	Technomare	270,000	SALM (Inv)	
	1984	Vega	Montedison	EMH	250,000	SALMRA	394
	1985	Mila	Montedison	Bluewater	70,000	CALM SYFPS	90
	1985	Rospo Mare	Elf	SBM	140,000	FSO turret	230
Ivory Coast	1980	Bouet	Societe Ivoirienne de Raffinage	IMODCO	250,000	3-24" CALM	164
	1981	Espoir	Phillips	Bluewater	240,000	1-12" CALM	279
Japan	1961	Niigata	Shell	Niigata	100,000	1-20" CALM	NA
	1963	Oita	Kyushu Oil	IMODCO	100,000	2-12" CALM	177
	1965	Yokkaichi	Showa-Yokkaichi	Mitsubishi	100,000	2-16" & 1-16" CALM	NA
	1965	Yokkaichi	Showa-Yokkaichi	Mitsubishi	100,000	2-16" & 1-16" CALM	NA
	1965	Chiba	Maruzen Oil	IMODCO	100,000	3-12" CALM	NA
	1967	Koshiba	US Army	IMODCO	100,000	2-12" CALM	65
	1968	Hakozaki	US Army	IMODCO	100,000	2-16" & 2-12" CALM	60
	1968	Kawasaki	Showa-Mitsubishi	Mitsubishi	265,000	2-24" CALM	NA
	1968	Hakodate	Asia Oil	IMODCO	32,000	1-16" CALM	49
	1968	Yokkaichi	Daikyo Oil	Mitsubishi	200,000	2-20" CALM	NA
	1968	Yokkaichi	Daikyo Oil	Mitsubishi	230,000	2-20" CALM	NA
	1969	Toyama	Japan Sea Oil	IMODCO	150,000	2-16" CALM	NA
	1969	Yokohama	Ogishima Oil	Mitsubishi	200,000	2-20" CALM	NA
	1969	Ube	Seibu Oil	Mitsubishi	200,000	2-20" CALM	NA
	1970	Atsumi	Chubu Electric	Mitsubishi	200,000	2-20" CALM	NA
	1970	Himeji	Idemitsui Oil	IMODCO	220,000	2-20" CALM	NA
	1970	Buckner Bay	Toyo Gasoline	IMODCO	100,000	2-16" CALM	NA
	1970	Tengan	US Army	IMODCO	50,000	2-12" CALM	70
	1971	Nakagusuki Bay	Esso	Esso, Van Houten	250,000	2-24" SALM	85
	1973	Ube	Seibu Oil	Mitsubishi	200,000	2-20" CALM	NA
	1974	Kawasaki	Showa-Mitsubishi	Mitsubishi	300,000	2-20" CALM	NA
	1975	Yokohama	Oghishima Oil	Mitsubishi	200,000	2-20" CALM	NA
	1976	Yokkaichi	Showa-Yokkaichi	Mitsubishi	300,000	1-20" & 1-20" CALM	NA
	1981	Mutsu-Ogawara	JNOC	SOFEC	350,000	2-24" SALM	145
	1983	Fuqui	JNOC	SOFEC	240,000	2-20" SALM	148
S Korea	1987	Inchon	NCS Kudong Oil Co	SBM	N A	CALM	N A
	1989	Daesan	KDO	SBM	250,000	CALM	101
Kuwait	1967	Ras Al Khafji	Arabian Oil	McDermott	150,000	1-16" & 1-12"	NA
	1972	Ras Al Khafji	Arabian Oil	McDermott	250,000	1-24" & 1-10"	NA
	1977	Mina-Al-Ahmadi	KOC	ETPM	532,000	2-24" & 1-16" RMD	NA
	1980	Ras al Kahfji	Arabian Oil	Mitsubishi	300,000	CALM	NA
Lebanon	1985	Beruit	Elec du Liban	EMH	40,000	SALM	118
Libya	1962	Brega	Esso	Esso	100,000	Fixed Tower Loading Arm	NA
	1965	Ras-es-Sider	Oasis	SBM	100,000	3-16" CALM	101
	1968	Zueitina	Occidental	SBM	100,000	1-24" CALM	100
	1968	Zueitina	Occidental	SBM	150,000	2-24" CALM	105
	1968	Zueitina	Occidental	SBM	150,000	2-24" CALM	105

Single point mooring around the world—*continued*

Country	Year	Port Field	Owner	Designer Contractor	Max. Vessel Size (Dwt)	Hose number Size System	Water Depth (Ft.)
	1969	Brega	Esso	Esso Van Houten	300,000	1-24" SALM	140
	1985	Marsa el Brega	Sirte Oil Co	IMODCO Ltd	300,000	2-24" CALM	148
	1969	Ras Lanuf	Mobil	SBM	255,000	2-24" CALM	96
	1969	Ras-es-Sider	Oasis	SBM	255,000	2-24" CALM	101
	1974	Azzawiya	NOC	DBV Woodfield	100,000	2-16"	NA
	1974	Azzawiya	NOC	DBV Woodfield	30,000	1-8" & 1-10"	NA
	1976	Azzawiya	NOC	SBM	140,000	2-20" SALM	85
	1976	Azzawiya	NOC	SBM	100,000	2-20" SALM	98
	1979	Zueitina	Occidental	IMODCO Ltd	275,000	2-24" CALM	99
	1980	Ras-es-Sider	Oasis	SBM	300,000	2-24" CALM	102
	1983	Ras-es-Sider	Oasis	IMODCO Ltd	NA	CALM	NA
Malaysia	1959	Miri	Shell	SBM	70,000	2-8" & 1-6" CALM	48
	1959	Miri	Shell	SBM	70,000	2-12" & 1-16" CALM	48
	1962	Miri	Shell	SBM	70,000	2-8" & 1-6" CALM	48
	1962	Port Dickson	Shell	SBM	100,000	2-16" CALM	90
	1963	Miri	Shell	SBM	70,000	2-12" & 1-6" CALM	53
	1974	Labuan	Shell	SBM	313,000	2-20" CALM	98
	1974	Tembungo	Exxon	SOFEC	94,000	1-10" SALM	300
	1974	Pulai	Exxon	SBM	190,000	1-12" SALM	240
	1977	Pulai	Exxon	SBM	166,000	SALS	216
	1978	Bintulu	Shell	SBM	210,000	2-20" CALM	67
	1981	Trengganu	Petronas	SOFEC	85,000	2-20" SALM	60
	1981	Trengganu	EPMI	SBM	250,000	1-24" SALM	92
	1981	Trengganu	EPMI	SBM	250,000	1-24" SALM	85
	1981	Paka	JGC Corp	SOFEC	85,000	CALM	65
	1982	Port Dickson	Shell	Mitsubishi	100,000	CALM	
	1984	Lutong	Shell	SBM	125,000	CALM	77
	1984	Lutong II	Shell	SBM	125,000	CALM	77
	1989	Dulang	Petronas	IMODCO	n.a	Turret mooring	n.a
Mexico	1973	Tuxpan	Pemex	IMODCO	60,000	2-16" CALM	60
	1974	Tuxpan	Pemex	IMODCO	60,000	1-10" & 3-16" CALM	67
	1976	Salina Cruz	Pemex	IMODCO	60,000	3-16" & 1-12" CALM	75
	1976	Rosarito Beach	Pemex	IMODCO	60,000	1-20" & 2-16" CALM	77
	1978	Rabon Grande	Pemex	IMODCO	150,000	1-16" & 2-20" CALM	90
	1980	Cayo Arcas	Pemex	IMODCO	151,000	2-24" & 1-16" CALM	144
	1980	Doc Bocas	Pemex	SBM	250,000	2-24" & 1-16" CALM	93
	1981	Cayo Arcas	Pemex	SBM	250,000	2-20" & 1-16" CALM	151
	1981	Dos Bocas	Pemex	SBM	250,000	2-24" & 1-16" CALM	93
	1981	Salina Cruz	Pemex	Mitsubishi	250,000	2-24" & 1-16" CALM	NA
	1981	Cayo Arcas	Pemex	EMH	285,000	2-20" RMD	131
	1981	NA	Pemex	SOFEC	2,000	SBBM (21)	150
	1985	Unknown	Pemex	Mitsubishi	150,000	CALM	93
Morocco	1971	Mohammedia	RAPC	IMODCO	100,000	1-8" & 1-20" CALM	72
New Caledonia	1977	Noumea	Le Nickel	SBM	100,000	1-20" CALM	62
New Zealand	1971	Waipipi Point	Marcona Corp	IMODCO	75,000	1-12" CALM	64
	1972	Taharoa	New Zealand Steel	IMODCO	70,000	2-12" CALM	77
	1976	Taharoa	New Zealand Steel	SBM	150,000	2-12" CALM	105
Nigeria	1967	Lagos	Nidogas	IMODCO	2,000	1-3" & 1-4" CALM	13
	1968	Escravos	Gulf	IMODCO	100,000	2-16" CALM	70
	1968	Forcados	Shell	SBM	210,000	1-20" CALM	83
	1968	Forcados	Shell	SBM	210,000	-124" CALM	83

Single point mooring around the world—*continued*

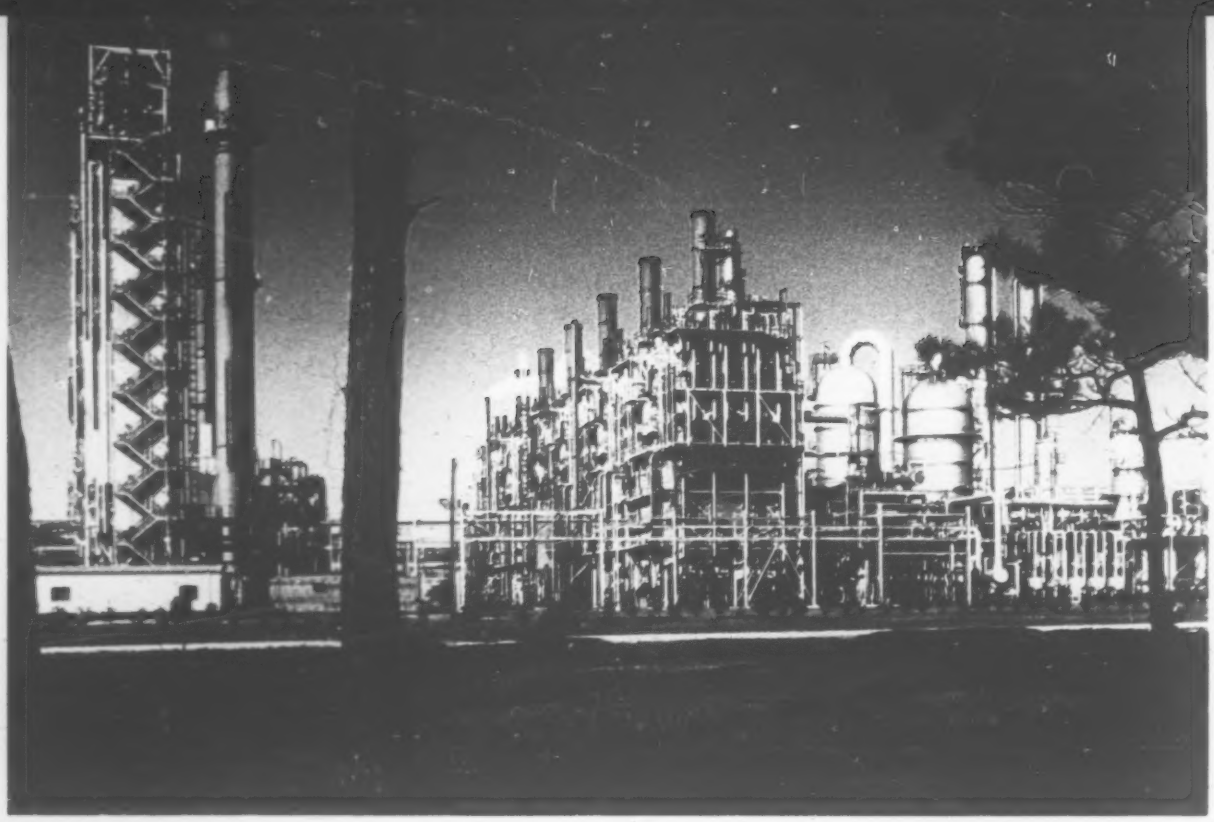
Country	Year	Port Field	Owner	Designer Contractor	Max. Vessel Size (Dwt)	Hose number Size System	Water Depth (Ft.)
	1971	Forcados	Shell	SBM	313,000	1-24" CALM	91
	1971	Bonny	Shell	SBM	313,000	1-24" CALM	91
	1971	Bonny	Shell	SBM	313,000	1-24" CALM	91
	1972	Brass River	Agip	IMODCO	200,000	2-20" CALM	96
	1974	North Apoi	Texaco	SBM	50,000	2-20" & 1-12" CALM	87
	1974	North Apoi	Texaco	SBM	250,000	2-20" CALM	93
	1976	Brass River	Agip	IMODCO	250,000	2-20" CALM	95
	1977	North Apoi	Texaco	SBM	250,000	2-24" CALM	94
	1977	Escravos	Gulf	SBM	300,000	2-24" CALM	102
	1979	Qua Iboe	Mobil	IMODCO	300,000	2-24" CALM	95
	1984	Andanga	Ashland	SBM	285,000	SY-Jacket	134
	1985	Qua Iboe	Mobil	IMODCO	380,000	2-24" CALM	95
	1985	Bonny	Shell	Bluewater	350,000	CALM	92
	1986	Antan	Ashland	SBM	285,000	Jacket SY	134
	1987	Brass	NAOC	SBM	N.A.	CALM	N.A.
	1989	Forcados	Shell	SBM	350,000	CALM	82
North Yemen	1986	Salif	YEPCO	SOFEC	N.A.	Turret moored FSO	N.A.
	1987	Ras Isa	YEPCO	SBM	N.A.	CALM	N.A.
Norway	1970	Ekofisk	Phillips	SBM	60,000	1-12" CALM	232
	1970	Ekofisk	Phillips	SBM	150,000	1-12" CALM	208
	1979	Statfjord B	Statoil	SBM	150,000	1-20" ALP	480
	1982	Statfjord C	Statoil	SBM	150,000	1-20" ALP	478
	1987	Statfjord A	Statoil	UKOLS	150,000	1-20" subsea	480
	1986	Gullfaks A	Statoil	SBM	150,000	1-20" ALP	445
	1987	Gullfaks B	Statoil	SBM	150,000	1-20" ALP	445
Oman	1963	Mina-al-Fahal	P.D. Oman	SBM	100,000	2-8" CALM	71
	1966	Mina-al-Fahal	P.D. Oman	SBM	165,000	2-16" & 1-8" CALM	115
	1966	Mina-al-Fahal	P.D. Oman	SBM	165,000	2-20" & 2-8" CALM	124
	1973	Mina-al-Fahal	P.D. Oman	SBM	500,000	2-20" & 2-8" CALM	155
	1979	Mina-al-Fahal	P.D. Oman	SBM	350,000	2-20" & 2-12" CALM	124
	1984	Kuria Muria	Shell	SBM	250,000	CALM	125
Panama	1981	Chiriqui Grande	Petroterminal de Panama	EMH	150,000	2-20" CALM	NA
	1981	Chiriqui Grande	Petroterminal de Panama	EMH	150,000	2-20" CALM	NA
	1983	Chiriqui Grande	Petroterminal de Panama	EMH	150,000	2-20" CALM	NA
Philippines	1967	Subic Bay	US Navy	IMODCO	108,000	2-16" & 1-10" CALM	85
	1977	S. Nido	Cities service	SBM	70,000	SBS	200
	1980	Bataan	Bataan Refining	SOFEC	300,000	2-24" SALM	94
	1980	Cadiao	Amoco	SBM	127,000	SBS	318
	1982	Nido	Cities Service	Bluewater	55,000	2-10" CALM	219
Qatar	1965	Halul	QGPC	SBM	100,000	2-16" CALM	97
	1972	Halul	QGPC	McDermott	300,000	2-24"	NA
	1972	Umm Said	QGPC	IMODCO	300,000	1-20" & 1-24" CALM	66
	1976	Dona	QGPC	SBM	65,000	1-6" CALM	88
	1979	Halul	QGPC	SBM	540,000	2-20" & 1-10" CALM	120
	1983	Umm Said	QGPC	IMODCO	500,000	CALM	NA
Saudi Arabia	1970	Zuluf	Aramco	SBM	250,000	2-24" & 1-16" CALM	111
	1970	Zuluf	Aramco	SBM	450,000	2-24" CALM	129
	1974	Ju aymah	Aramco	McDermott	500,000	2-24" & 1-12"	NA
	1974	Ju aymah	Aramco	McDermott	500,000	2-24" & 1-12"	NA
	1974	Ju aymah	Aramco	McDermott	500,000	2-24" & 1-12"	NA
	1975	Ju aymah	Aramco	SOFEC	750,000	2-24" & 1-12" CALM	135
	1975	Ju aymah	Aramco	SOFEC	750,000	2-24" & 1-12" SALM	117
	1981	Ras Al Khafji	Aramco	Mitsubishi	300,000	1-24" & 1-10" CALM	NA
	1987	Duba	ODR	SBM	N.A.	CBM	N.A.
Singapore	1971	Singapore Harbor	Esso	IMODCO	252,000	2-24" CALM	88
	1974	Pulau Bukom	Shell	McDermott	300,000	2-24"	NA
	1980	Singapore Harbor	PSA	IMODCO	300,000	2-24" CALM	105

Single point mooring around the world—*continued*

Country	Year	Port Field	Owner	Designer Contractor	Max. Vessel Size (Dwt)	Hose number Size System	Water Depth (Ft.)
South Africa	1969	Durban	Shell	SBM	210,000	2-20" CALM	150
	1974	Durban	Shell	SBM	210,000	1-20" CALM	150
South Korea	1963	Ulsan	KOC	IMODCO	75,000	2-12", 1-8" & 1-4" CALM	65
	1969	Yosu	Honam Oil	IMODCO	100,000	2-16" CALM	112
	1969	Ulsan	KOC	IMODCO	200,000	2-16" & 1-12" CALM	88
	1977	Onsan	KIPCO	IMODCO	250,000	2-24" CALM	90
	1980	Pusan	KOC	Mitsubishi	325,000	2-24" & 1-16"	NA
South Yemen	1989	Bir Ali	Machino-import	SBM	20,000	CALM	67
Spain	1966	Huelva	Rio Tinto	SBM	100,000	2-16" CALM	75
	1971	Amposta	Shell	SBM	33,530	2-10" CALM	209
	1973	Tarragona	Enpetrol	SBM	325,000	2-24" & 1-12" CALM	135
	1975	Algeciras	Cepsa	DBV Woodfield	500,000	2-20" & 1-12"	NA
	1976	Castellon	Shell	SBM	60,000	SALS	383
	1979	Badalona	Campsa	SOFEC	50,000	2-12" SALM	107
Sri Lanka	1986	Columbo Harbor	Ceylon Pet. Co	IMODCO	180,000	CALM 1-24	95
Sudan	1983	Marsa Nimeiri	Chevron	SBM	250,000	CALM (HEX)	160
Sweden	1959	Dalaro	Swedish Navy	IMODCO	3,000	1-4" CALM	150
Taiwan	1967	Tai-Chung	US Air Force	IMODCO	50,000	1-12" CALM	76
	1968	Kaohsiung	CPC	IMODCO	100,000	2-16" & 1-10" CALM	68
	1968	Tai-Chung	US Air Force	IMODCO	50,000	1-12" CALM	76
	1971	Kaohsiung	CPC	SBM	250,000	2-20" CALM	100
	1972	Kaohsiung	CPC	SBM	250,000	2-20" CALM	115
	1979	Chu-Wei	CPC	IMODCO	250,000	2-20" CALM	121
	1981	Ta-Lin-Po	CPC	SBM	250,000	2-24" & 1-16" CALM	130
Tanzania	1971	Dar-Es-Salaam	Tanzanian Harbour Authorities	SBM	100,000	2-20" CALM	78
	1982	Dar Es Salaam	T.H.A.	IMODCO	300,000	CALM	
Thailand	1979	Gulf of Thailand	Union	Bluewater	70,000	1-8" CALM Yoke	NA
	1981	Erawan	Union	Bluewater	85,000	1-8" CALM	219
Trinidad	1971	Galeota Point	Amoco	SBM	250,000	2-20" CALM	95
	1973	Point-A-Pierre	Texaco	IMODCO	260,000	1-12" & 2-24" CALM	78
	1976	Galeota Point	Amoco	IMODCO	250,000	2-20" CALM	95
Tunisia	1972	Ashtart	Elf	SBM	170,000	SBS	220
	1974	Ashtart	Elf	SBM	100,000	1-20" CALM	220
	1978	Ashtart	Serept	SBM	137,000	1-20" & 1-10" SBS	220
	1982	Tazerka	Shell-Tunirex	SBM	210,000	SALS	470
United Arab Emirates	1968	Fateh	Conoco	SBM	150,000	2-16" CALM	103
	1972	Das Island	BP	IMODCO	300,000	2-24" & 1-16" CALM	94
	1972	Fateh	Dubai Petroleum	McDermott	300,000	2-24"	NA
	1972	Mubarras Island	ADOC	SBM	200,000	1-24" CALM	58
	1973	Mubarek	Crescent	SBM	350,000	2-20" & 1-16" CALM	160
	1974	Abu Al Bu Koosh	Total Abk.	SBM	100,000	2-12" CALM	97
	1977	Das Island	ADMA	IMODCO	400,000	2-24" & 1-16" CALM	94
	1977	Arzanah	Amerada Hess	SBM	252,000	1-12" CALM	107
	1979	Fateh	Dupetco	IMODCO	170,000	2-20" CALM	130
	1980	Zirku	Zadco	IMODCO	350,000	2-20" & 1-20" CALM	95

Single point mooring around the world—*continued*

Country	Year	Port Field	Owner	Designer Contractor	Max. Vessel Size (Dwt)	Hose number Size System	Water Depth (Ft.)
	1980	Zakum Zirku	Zadco	IMODCO	350.000	2-20" & 1-20" CALM	95
	1981	Sharjah	Amoco	SBM	300.000	1-20" CALM	65
	1981	Abu-Al-Koosh	Total	EMH	232.799	1-10"	NA
	1983	Salah	Gulf Ras al Khaimah	IMODCO	300.000	CALM	100
United Kingdom	1965	Nore Estuary	BP	BP Harland Wolff	100.000	NA	NA
	1970	Humber River	Conoco	SBM	210.000	1-24" CALM	74
	1972	Auk	Shell Esso	Shell SBM	42.000	1-10" SLSBM	280
	1973	Argyll	Hamilton Bros	SBM	100.000	1-12" CALM	252
	1975	Brent	Shell Esso	Shell HC	90.000	NA	NA
	1975	Anglesey	Shell	SBM	750.000	2-24" & 1-16" CALM	127
	1975	Scapa Flow	Occidental	Micoperi	250.000	NA	NA
	1975	Scapa Flow	Occidental	Micoperi	250.000	NA	NA
	1975	Thistle	BNOC	SBM	80.000	2-16" SALM	535
	1977	Brent	Shell	SBM	80.000	1-16" CALM	460
	1978	Buchan	BP	IMODCO	107.000	1-12" CALM	369
	1979	Ninian	Chevron	IMODCO	3.500	SBBM	433
	1980	Ninian	Chevron	IMODCO	3.500	SBBM(4)	433
	1982	Maureen	Phillips	EMH	85.000	1-16" AC	NA
	1980	Humber River	Conoco	SBM	280.000	1-24" CALM	74
	1982	Beryl B	Mobil	EMH	80.000	1-16" ALP	NA
	1984	Cardigan Bay	M.O.D	Havron	10.000	SPLM	100
	1985	Fulmar	Shell	Bluewater	100.000	ALPRA HEAD	360
	1985	Beryl A	Mobil	EMH	100.000	ALP	
United States	1967	Louisiana	Kerr-McGee	McDermott	8.000	1-4	NA
	1978	Worldwide (portable)	US Navy Ltd	IMODCO	70.000	2-10" CALM	65-200
	1980	Louisiana	Loop	SOFEC	700.000	2-24" SALM	110
	1980	Louisiana	Loop	SOFEC	700.000	2-24" SALM	112
	1980	Louisiana	Loop	SOFEC	700.000	2-24" SALM	114
	1981	Santa Ynez	Exxon	IMODCO	50.000	1-12" 1-8" 6-1 & 1-6" SALM	494
	1984	Unknown	Brown & Root	IMODCO	550.000	Chain SALM	125
	1984	Unknown	Brown & Root	IMODCO	550.000	Chain SALM	125
Uruguay	1975	Jose Ignacio	Ancap	SBM	150.000	2-24" CALM	64
	1985	Jose Ignacio	Ancap	SBM	150.000	CALM	64
Venezuela	1968	Moron	CVP	SBM	100.000	2-16" CALM	63
Vietnam	1989	White Tiger	Petechim Vietsovpetro	SBM	150.000	CALM	164
West Germany	1962	Cuxhaven	West Germany Navy	IMODCO	2.500	1-4" CALM	26
Western Sahara	1961	El Aaiun	CEPSA	IMODCO	3.000	1-6" CALM	28
Zaire	1975	Zaire	Gulf	IMODCO	100.000	2-16" CALM	71
	1976	Zaire	Gulf	IMODCO	79.200	2016" CALM	79
	1989	Muanda	ZAGOC	SBM	25.000	CALM	79



OGJ100 lists non-U.S. oil and gas companies

THE OIL & GAS JOURNAL'S OGJ100 IS A compilation of financial and operating information from major non-U.S. oil and gas companies around the world.

The list compares the size and performance of prominent individual companies.

The information available for this initial survey is not complete for all of the companies. Many of the state oil and gas companies report only production and reserves information, not financial data.

For this reason, the companies have not been ranked but instead are listed by region based on the location of the corporate headquarters.

OGJ has listed the top twenty companies in this year's initial group according to crude oil production and reserves.

As would be expected these lists are dominated by the state oil companies from the major producing countries.

The leading non-government controlled company in both reserves and production is Royal Dutch/Shell.

The major international oil companies headquartered in the U.S. have not been included in the list, but some would rank in the top 20. If they were included, Exxon would rank 5th in worldwide production—slightly ahead of Shell. Other U.S. companies that would make the top 20 list in terms of worldwide liquids production are Texaco, Chevron, Amoco, Arco, and Mobil.

In worldwide liquid reserves, Exxon would rank 10th. The list would also include Chevron, Arco, and Texaco.

U.S. publicly held oil and gas companies are ranked by assets in a separate listing, the OGJ400.

OGJ100: reserves and production leaders

Rank	Company	Reserves, million bbl
1	Arabian American Oil Co.	169,970.0
2	Iraq National Oil Co.	100,000.0
3	National Iranian Oil Co.	92,850.0
4	Abu Dhabi National Oil Co.	92,205.0
5	Kuwait Oil Co.	91,920.0
6	Petroleos de Venezuela SA	58,504.0
7	Petroleos Mexicanos	53,012.0
8	Royal Dutch/Shell	8,839.0
9	Sonatrach (Algeria)	8,400.0
10	Oil and Natural Gas Commission (India)	6,354.0
11	British Petroleum Co. plc	5,224.0
12	Ente Nazionale Idrocarburi (Italy)	4,573.9
13	Petroleum Development Oman	4,071.0
14	Dubai Petroleum Co.	4,000.0
15	Qatar General Pet. Corp.	3,150.0
16	Petronas (Malaysia)	2,900.0
17	Petroleo Brasileiro SA	2,816.0
18	Yacimentos Petroliferos Fiscales SE (Argentina)	2,268.0
19	Syrian Petroleum Co.	1,730.0
20	Imperial Oil Ltd. (Canada)	1,631.0
	Total	714,417.9

Rank	Company	Production, million bbl
1	Arabian American Oil Co.	1,803.7
2	Iraq National Oil Co.	983.8
3	Petroleos Mexicanos	917.4
4	National Iranian Oil Co.	819.8
5	Royal Dutch/Shell	645.3
6	Petroleos de Venezuela SA	627.7
7	British Petroleum Co. plc	567.3
8	Kuwait Oil Co.	439.2
9	Abu Dhabi National Oil Co.	378.6
10	Nigerian National Petrol. Corp.	340.4
11	National Oil Corp. (Libya)	325.6
12	Oil and Natural Gas Commission (India)	232.0
13	Soc. Nat. Elf Aquitaine	232.0
14	Sonatrach (Algeria)	228.4
15	Petroleum Development Oman	221.4
16	Pertamina (Indonesia)	218.3
17	Petroleo Brasileiro SA	211.2
18	Petronas (Malaysia)	191.1
19	Yacimentos Petroliferos Fiscales SE (Argentina)	161.1
20	Dubai Petroleum Co.	132.8
	Total	9,677.0

Leading oil and gas companies around the world

Country	Company	Total assets		Total revenues		Total net income		Capital and exploratory expenditures	
		$ million							
		1988	1987	1988	1987	1988	1987	1988	1987
CANADA									
Canada	Alberta Energy Co. Ltd.	1,619.3	1,430.1	390.9	350.1	41.8	38.8	129.2	114.2
Canada	American Eagle Petroleum Ltd.	98.9	73.4	28.1	19.3	(0.7)	(1.8)	24.0	9.1
Canada	American Hunter Exploration Ltd.	71.7	49.8	12.9	0.2	(8.6)	(11.4)	13.2	6.8
Canada	Amoco Canada Petroleum Co. Ltd.	6,072.3	1,659.7	1,690.3	1,140.2	(42.5)	109.9	203.8	111.1
Canada	Bow Valley Industries Ltd.	1,114.9	754.3	217.6	194.0	8.4	35.2	407.2	118.5
Canada	BP Canada Inc.	736.7	648.5	[2]249.4	[2]231.2	8.4	33.7	229.7	139.0
Canada	Canadian Hunter Exploration Ltd.	443.4	431.0	93.0	65.3	[4](58.2)	11.9	90.0	58.7
Canada	Canada Northwest Energy Ltd.	391.3	458.9	91.2	67.9	(91.1)	15.2	71.3	92.1
Canada	Canadian Occidental Petroleum Ltd.	1,136.9	1,137.3	601.3	451.7	43.3	43.7	119.0	156.6
Canada	Canadian Roxy Petroleum Ltd.	159.7	144.0	17.2	17.8	(0.8)	1.2	11.2	11.8
Canada	Canadian Western Natural Gas Co. Ltd.	334.0	291.5	242.1	233.1	12.5	10.6	22.2	22.2
Canada	Chevron Canada Resources	918.6	751.5	643.5	689.3	88.4	145.5	299.4	171.6
Canada	Cooperative Energy Development Corp.	175.2	156.0	21.2	20.2	(0.6)	0.9	15.5	21.4
Canada	Conwest Exploration Co. Ltd.	292.8	233.5	79.4	79.7	10.5	25.5	12.8	7.9
Canada	Denison Mines Ltd.	[2]231.1	[2]369.0	[2]113.6	[2]133.0	[2]11.0	[2]49.0	[2]22.5	[2]39.5
Canada	Gulf Canada Resources Ltd.	3,116.4	2,531.2	[2]707.2	[2]335.7	[2]54.5	[2]73.9	[2]301.6	[2]178.8
Canada	Home Oil Company Ltd.	2,513.9	2,271.4	195.4	199.4	15.4	15.1	0.2	0.1
Canada	Imperial Oil Ltd.	8,112.6	7,291.9	5,857.1	5,786.8	407.3	561.9	1,118.6	1,098.2
Canada	Interhome Energy Inc.	[1]2,513.9	[1]2,271.4	[1]697.7	[1]646.9	[1]97.0	[1]92.3	[1]263.8	[1]204.6
Canada	Inverness Petroleum Ltd.	72.8	55.6	16.1	5.6	(0.4)	(1.8)	9.9	3.4
Canada	Norcen Energy Resources Ltd.	1,941.0	1,718.4	594.7	554.2	74.5	74.8	206.6	108.5
Canada	Paloma Petroleum Ltd.	72.6	60.9	13.5	10.4	2.7	3.1	[3]5	6.9
Canada	PanCanadian Petroleum Ltd.	2,241.9	1,811.0	561.2	527.0	101.2	136.6	[2]590.4	161.6
Canada	Petro-Canada	7,219.7	6,503.3	3,902.8	3,830.9	76.4	129.7	649.5	364.3
Canada	Placer Dome Inc.	336.1	335.9	[2]72.8	[2]82.5	(12.6)	7.2	49.8	46.5
Canada	Prairie Oil Royalties Co., Ltd.	83.1	72.0	12.3	12.8	2.9	5.2	[2]24.3	[2]9.6
Canada	Ranger Oil Ltd.	458.6	362.2	94.7	72.7	15.4	17.9	98.8	20.0
Canada	Saskatchewan Oil and Gas Corp.	569.5	285.6	[1]95.3	[1]91.2	(7.1)	17.0	67.7	39.6
Canada	Sceptre Resources Ltd.	399.7	584.7	74.1	48.9	5.1	6.2	49.1	26.4
Canada	Scurry-Rainbow Oil Ltd.	272.5	257.5	57.1	61.2	12.3	17.5	60.1	32.2
Canada	Shell Canada Ltd.	4,707.8	4,238.3	4,113.4	3,663.5	347.1	264.0	360.1	304.7
Canada	Sunoco Inc.	1,696.1	1,600.2	1,093.4	1,033.3	(39.8)	36.2	165.0	107.1
Canada	Teck Corp.	[2]698.4	486.7	201.6	153.5	75.3	25.4	16.0	3.1
Canada	Texaco Canada Inc.	3,435.0	2,979.7	2,164.0	2,115.0	270.7	241.4	332.5	189.3
Canada	Total Petroleum (North America) Ltd.	962.9	780.2	1,833.5	1,317.7	72.7	(20.2)	116.9	99.5
Canada	Union Enterprises Ltd.	1,511.7	NA	1,132.0	NA	46.9	NA	121.9	NA
Canada	Westcoast Petroleum Ltd.	635.7	584.3	88.8	81.2	14.5	19.4	59.5	153.3
LATIN AMERICA									
Argentina	Yacimentos Petroliferos Fiscales SE	NA	NA	NA	NA	NA	NA	NA	NA
Bolivia	Yacimentos Petroliferos Fiscales Boliviano	NA	NA	NA	NA	NA	NA	NA	NA
Brazil	Petroleo Brasilieiro SA	13,691.6	15,576.3	[2]12,969.3	[2]15,604.6	265.3	93.8	2,172.0	3,057.0
Chile	Empressa Nacional del Petroleo	NA	NA	NA	NA	NA	NA	NA	NA
Colombia	Empresa Colombiana de Petroleos	NA	2.4	NA	2.0	NA	0.1	NA	145.5
Ecuador	Corporacion Estatal Petrolera Ecuatoriana	NA	NA	NA	NA	NA	NA	NA	NA
Mexico	Petroleos Mexicanos	46,155.0	34,729.4	[2]13,125.6	[2]13,240.7	574.7	1,887.8	1,006.3	834.0
Peru	Petroleos del Peru	NA	NA	NA	NA	NA	NA	NA	NA
Suriname	State Oil Co. Suriname NV	33.1	25.4	13.8	12.7	0.6	1.8	13.7	7.4
Venezuela	Petroleos de Venezuela SA	27,255.0	26,873.7	9,512.7	10,928.4	801.1	1,420.1	108.7	138.5
West Indies	Barbados National Oil Co. Ltd.	20.1	19.5	8.5	6.8	0.6	(2.2)	4.4	4.2
WESTERN EUROPE									
Austria	OMV Aktiengesellschaft	NA	NA	NA	NA	NA	NA	NA	NA
Belgium	Petrofina SA	9,575.2	8,552.3	13,591.7	11,757.2	548.6	409.8	1,765.3	883.8
Denmark	Dansk Olie Og Naturgas AS	1,561.1	1,777.7	613.3	647.5	(43.2)	7.6	72.6	49.2
France	Soc. Nat. Elf Aquitaine	NA	28,765.7	NA	22,501.2	1,177.6	691.1	3,869.4	3,048.2

Worldwide oil production Mill bbl		Worldwide natural gas production Bcf		Worldwide oil reserves Mill bbl		Worldwide natural gas reserves Bcf	
1988	1987	1988	1987	1988	1987	1988	1987
[1]2.4	[1]1.8	[1]102.5	[1]85.0	20.7	NA	1,740.0	NA
0.4	0.3	1.9	1.7	5.5	4.3	67.8	38.3
0.0	0.0	0.0	0.0	NA	NA	NA	NA
24.0	21.0	203.0	114.2	317.0	117.3	4,901.0	2,135.0
14.0	12.9	51.7	21.9	71.2	73.8	974.6	494.4
[2]8.8	[2]8.5	48.3	47.5	[2]182.2	[2]187.5	782.9	786.5
2.7	2.0	58.2	37.6	[3]0.1	[3]0.1	[3]1,393.0	[3]1,342.0
5.5	3.4	10.5	8.7	93.6	90.2	213.1	200.7
8.8	8.7	74.5	56.5	90.9	86.8	1,044.6	869.5
1.0	1.0	4.3	4.3	16.6	16.5	124.2	125.3
0.0	0.0	4.0	3.3	0.0	0.0	130.2	134.0
33.6	29.8	70.2	75.7	456.0	453.0	1,607.0	1,672.0
1.0	0.9	7.0	5.7	12.5	11.2	144.0	114.8
0.8	0.6	5.1	4.5	[3]16.3	[3]9.2	[3]128.2	[3]94.4
9.4	8.9	5.2	4.9	95.0	95.0	65.0	72.0
8.0	7.4	136.6	116.3	[2]209.0	[2]196.0	[2]1,572.0	[2]1,453.0
11.9	0.0	0.1	0.1	115.6	107.3	1,050.3	959.1
[1]97.7	[1]89.4	143.5	92.7	[1]1,631.0	[1]1,489.0	[2]2,478.0	[2]1,914.0
10.0	9.5	54.2	41.5	93.8	89.3	1,050.3	959.1
0.7	0.3	4.1	2.0	6.0	4.3	45.9	39.2
16.4	15.4	66.8	55.8	[3]134.0	[3]125.6	[3]1,164.9	[3]1,143.6
0.4	0.3	9.9	7.4	[4]2.9	[4]2.8	[4]156.9	[4]152.7
[1]26.5	[1]21.8	[1]149.0	[1]125.0	[3]440.3	[3]263.4	[4]3,242.0	[4]3,508.0
33.5	32.9	177.6	158.8	779.7	753.1	[3]4,074.6	[3]4,008.6
2.7	3.2	16.7	16.6	[3]16.4	[3]16.7	[4]193.1	[4]161.2
0.8	0.7	3.1	2.2	7.1	4.4	64.4	52.0
5.3	4.4	9.5	7.3	31.4	21.6	99.8	107.3
6.6	5.6	21.1	4.2	[3]86.7	[3]83.3	[3]928.0	[3]94.7
3.3	2.2	38.9	19.9	[3]33.6	[3]32.7	[3]548.9	[3]552.9
3.6	3.5	13.6	0.0	28.0	24.0	258.6	206.0
19.8	20.3	187.4	167.5	140.9	145.9	3,340.3	3,206.1
23.0	21.1	29.7	23.2	358.5	390.0	388.4	423.7
0.5	0.5	2.9	2.7	4.5	3.8	48.0	53.2
27.5	26.2	54.2	38.7	305.0	310.0	1,514.0	1,529.0
4.7	5.0	[1]22.0	[1]0.0	32.0	39.9	269.1	339.4
2.1	NA	12.7	NA	29.3	NA	533.0	NA
5.6	4.4	21.6	16.6	65.3	65.4	719.4	707.3
161.1	156.2	757.4	659.6	2,268.0	2,270.0	26,700.0	23,600.0
NA	5.3	NA	NA	NA	NA	NA	NA
211.2	215.4	0.0	0.0	2,816.0	2,550.0	3,845.3	3,718.1
8.9	11.2	56.3	70.8	287.0	290.0	4,200.0	4,200.0
NA	28.1	NA	140.6	NA	2,028.0	NA	3,943.4
69.9	41.2	NA	NA	NA	NA	NA	NA
917.4	927.3	1,273.1	1,276.9	53,012.0	54,110.0	73,356.0	74,831.0
51.7	60.4	46.1	46.0	457.0	512.0	623.0	650.0
1.2	0.8	0.0	0.0	30.0	23.0	0.0	0.0
627.7	559.9	1,343.7	1,275.6	58,504.0	58,084.0	101.0	100.3
0.5	0.5	1.1	1.1	3.3	3.6	6.8	7.4
6.9	5.8	NA	NA	NA	NA	NA	NA
41.5	38.4	151.2	132.7	0.0	0.0	4.5	3.9
35.1	34.1	84.6	85.7	861.0	440.0	4,320.0	4,400.0
232.0	214.4	829.3	890.0	NA	1,346.0	NA	4,819.8

Leading oil and gas companies around the world (continued)

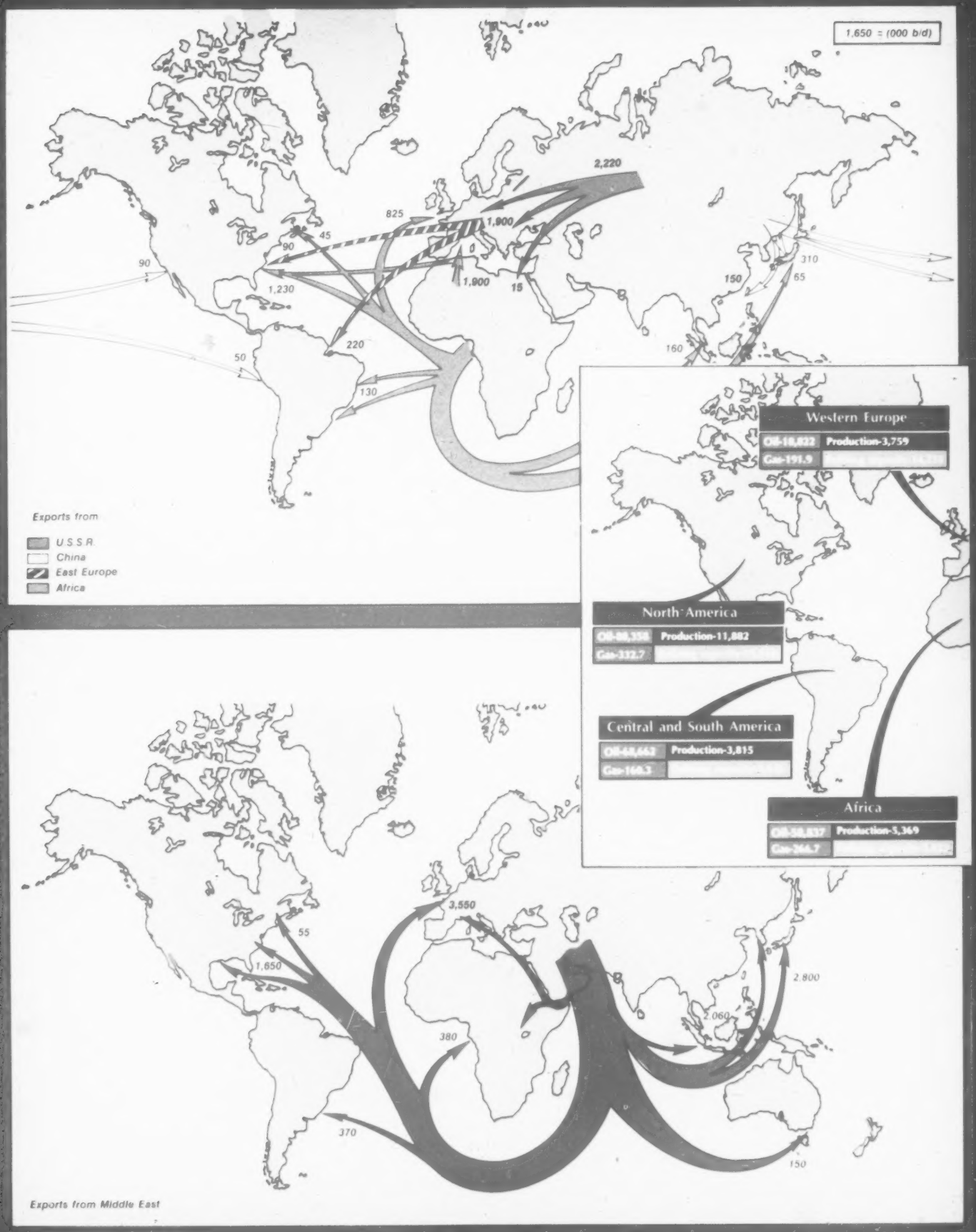
Country	Company	Total assets		Total revenues		Total net income		Capital and exploratory expenditures	
		$ million							
		1988	1987	1988	1987	1988	1987	1988	1987
France	**Total CFP**	14,515.1	14,051.3	14,012.2	14,448.5	328.9	212.4	2,414.5	1,423.5
Germany, West	**Deminex**	1,741.3	1,707.2	513.5	668.7	NA	NA	485.0	266.4
Germany, West	**Wintershall AG**	NA	1.5	NA	2.1	NA	0.0	NA	0.1
Italy	**Ente Nazionale Idrocarburi**	22,729.5	22,978.1	25,487.0	24,495.6	1,913.3	546.6	1,512.3	1,957.8
Netherlands	**Royal Dutch Shell**	57,999.9	55,811.9	99,440.9	98,024.2	5,239.0	4,639.7	9,243.5	7,125.9
Norway	**Norsk Hydro AS**	10,097.1	9,700.7	9,224.2	8,098.7	317.3	206.8	1,357.8	1,453.2
Norway	**Saga Petroleum SA**	1,641.2	1,505.5	222.8	211.6	7.8	0.0	14.2	18.1
Norway	**Statoil**	7,118.0	7,046.6	5,789.0	6,303.6	61.2	(216.9)	1,374.7	1,556.5
Spain	**Repsol SA**	6,306.0	6,291.0	8,193.0	7,839.0	486.0	386.0	538.0	373.0
Switzerland	**International Petroleum Corp.**	28.8	27.1	[27]9.5	12.5	(10.8)	(5.1)	22.5	8.4
Turkey	**Turkish Petroleum Corp.**	755.9	1,077.5	[28]147.2	[28]200.0	[4]238.9	[4]429.8	136.4	139.4
United Kingdom	**British Petroleum Co. plc**	21,952.9	21,089.9	46,176.4	46,426.8	2,155.4	2,279.7	10,390.7	5,608.9
United Kingdom	**Clyde Petroleum plc**	[30]537.1	[30]227.9	71.8	60.3	5.5	6.7	271.7	48.8
United Kingdom	**London and Scottish Marine Oil plc**	1,172.7	521.8	240.5	242.6	397.4	36.5	110.4	105.1
AFRICA									
Algeria	**Sonatrach**	NA	NA	NA	NA	NA	NA	NA	NA
Benin	**Projet Petrolier Seme-Ashland**	57.5	97.9	27.1	31.0	21.6	25.3	23.5	17.3
Libya	**National Oil Corp.**	NA	NA	NA	NA	NA	NA	NA	NA
Morocco	**Office Nat. de Recherches & D'Exploitation Petroliere**	NA	NA	NA	NA	NA	NA	NA	NA
Nigeria	**Nigerian National Petrol. Corp.**	NA	NA	NA	NA	NA	NA	NA	NA
MIDDLE EAST									
Abu Dhabi	**Abu Dhabi National Oil Co.**	[29]NA	NA	NA	NA	NA	NA	NA	NA
Bahrain	**Bahrain National Oil Co.**	NA	NA	NA	NA	NA	NA	NA	NA
Dubai	**Dubai Petroleum Co.**	NA	NA	NA	NA	NA	NA	NA	NA
Iran	**National Iranian Oil Co.**	NA	NA	NA	NA	NA	NA	NA	NA
Iraq	**Iraq National Oil Co.**	NA	NA	NA	NA	NA	NA	NA	NA
Israel	**Isramco Inc.**	3.2	3.6	0.2	0.3	(0.3)	(0.9)	0.1	0.9
Kuwait	**Kuwait Petroleum Corp.**[31]	21,411.0	21,810.1	12,333.8	10,631.6	432.8	252.9	982.0	851.7
Oman	**Petroleum Development Oman**	NA	NA	NA	NA	NA	NA	NA	NA
Qatar	**Qatar General Pet. Corp.**	NA	NA	NA	NA	NA	NA	NA	NA
Saudi Arabia	**Arabian American Oil Co.**	NA	NA	NA	NA	NA	NA	NA	NA
Syria	**Syrian Petroleum Co.**	NA	NA	NA	NA	NA	NA	NA	NA
ASIA PACIFIC									
Australia	**BHP Petroleum Pty Ltd.**	5,151.7	3,340.9	2,309.4	1,773.9	285.5	202.5	519.0	309.7
Australia	**Bridge Oil Ltd.**	502.3	323.6	49.6	38.2	20.7	15.1	116.0	24.6
Australia	**Crusader Ltd.**	198.2	160.4	76.8	51.7	6.3	3.3	17.6	10.8
Australia	**Hartogen Energy Ltd.**	NA	206.5	30.3	20.1	9.3	5.2	NA	36.4
Australia	**Magellan Petroleum Australia Ltd.**	38.1	35.6	13.1	9.1	4.3	0.7	1.6	3.8
Australia	**Meridian Oil NL**	11.7	3.6	0.2	1.4	3.2	(8.7)	0.9	3.2
Australia	**Petroz NL**	109.0	202.9	83.6	37.6	(76.1)	(17.2)	9.3	7.6
Australia	**Santos Ltd.**	2,401.7	1,709.4	395.8	425.6	1.7	82.1	450.7	476.7
Burma	**Myanma**	NA	NA	NA	NA	NA	NA	NA	NA
India	**Oil and Natural Gas Commission**	NA	NA	NA	NA	NA	NA	NA	NA
Indonesia	**Pertamina**	NA	NA	NA	NA	NA	NA	NA	NA
Japan	**Idemitsu Kosan Co. Ltd.**	9,982.4	NA	12,175.7	NA	10.0	NA	NA	NA
Korea	**Yukong Ltd.**	1,883.8	1,425.8	3,379.1	3,229.6	84.8	52.1	384.0	264.0
Malaysia	**Petronas**	8,046.9	8,356.4	2,588.8	2,308.3	854.9	938.2	158.5	92.1
New Zealand	**New Zealand Oil & Gas Ltd.**	25.3	19.5	17.7	1.8	6.9	0.0	5.8	1.5
New Zealand	**Southern Petroleum No Liability**	33.9	31.0	4.5	1.6	2.4	(4.5)	27.9	21.8
Philippines	**Philippine National Oil Co.**	1,300.1	1,344.6	974.0	889.3	60.5	36.4	35.6	32.4
Taiwan (China)	**Chinese Petroleum Corp.**	8,674.2	7,642.8	7,514.7	7,388.8	2,170.9	2,219.3	963.6	748.5

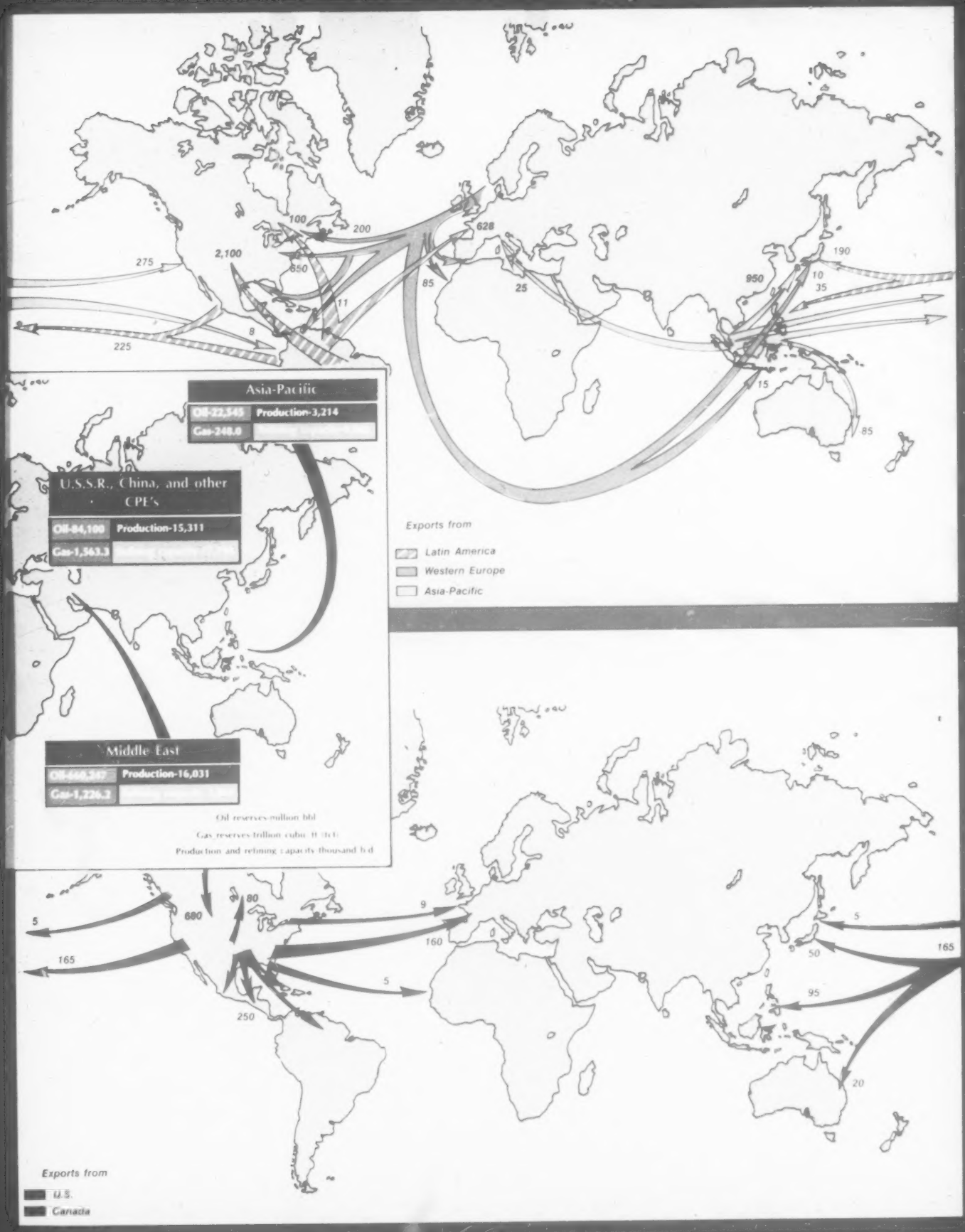
NA – Not Available. Fiscal yearend is Dec. 31 unless otherwise noted. 1. Sales only. 2. After royalties. 3. Includes Bitumen. 4. After unusual writedown of $75,758. 5. Proved and probable. 6. Oil and gas only. 7. Operating income. 8. Proved and undeveloped. 9. 6 mths only - acquisition of Gulf Canada Corp. Oil & Gas Division. 10. Gross. 11. Oil, gas and pipeline only. 12. Proved. 13. Includes $438.3 million for net prop. acquisitions. 14. Before royalty. 15. Before taxes. 16. Net of government incentives. 17. Crude oil, natural gas.

Worldwide oil production Mill bbl		Worldwide natural gas production Bcf		Worldwide oil reserves Mill bbl		Worldwide natural gas reserves Bcf	
1988	1987	1988	1987	1988	1987	1988	1987
121.7	106.3	229.5	208.3	[22]3.4	[22]3.4	[22]5,014.0	[22]4,660.9
29.5	29.1	13.2	14.4	[23]775.0	[23]621.0	[23]500.0	[23]1,200.0
NA	24.7	NA	66.9	NA	NA	NA	NA
95.3	126.1	617.9	568.5	[24]4,573.9	[24]4,060.8	[24]0.0	[24]0.0
[1]645.3	[1]644.6	2,193.4	2,386.4	8,839.0	8,419.0	38,687.0	39,085.0
[1]14.1	8.8	[1]208.9	136.8	508.0	545.8	5,619.9	5,984.3
[25]6.5	[25]5.8	[25]7.4	[25]7.1	NA	NA	NA	NA
128.3	124.5	98.9	102.4	1,100.1	1,017.1	1,638.4	1,038.1
48.4	42.6	25.4	20.5	381.0	378.0	296.0	318.0
0.1	0.2	0.0	0.0	54.0	30.0	1.2	0.0
10.3	10.4	3.5	10.5	NA	NA	NA	NA
567.3	520.1	397.1	304.8	[29]5,224.0	[29]5,005.0	[29]11,813.0	[29]18,575.0
4.8	4.2	4.6	0.3	116.0	89.9	334.9	157.6
17.8	14.5	8.1	7.7	215.2	160.4	0.3	0.3
228.4	230.7	1,542.4	1,471.6	8,400.0	8,500.0	104,200.0	105,900.0
1.6	1.9	NA	NA	NA	NA	NA	NA
325.6	345.3	NA	NA	NA	NA	NA	NA
0.1	0.1	2.9	2.6	NA	NA	NA	NA
340.4	311.3	NA	NA	NA	NA	NA	NA
378.6	395.4	461.9	445.3	92,205.0	92,205.0	183,500.0	183,500.0
15.7	14.3	184.9	175.8	126.0	141.0	6,700.0	6,900.0
132.8	137.8	95.2	91.8	4,000.0	4,000.0	5,015.0	6,000.0
819.8	843.2	620.0	670.7	92,850.0	92,850.0	494,400.0	489,400.0
983.8	792.1	110.4	59.9	100,000.0	100,000.0	95,000.0	26,300.0
NA	NA	NA	NA	NA	NA	NA	NA
439.2	370.8	174.6	156.1	91,920.0	91,920.0	42,500.0	36,400.0
221.4	212.4	73.2	62.4	4,071.0	4,012.0	9,320.0	9,500.0
126.6	106.9	204.2	164.4	3,150.0	3,150.0	156,700.0	156,700.0
1,803.7	1,456.7	899.3	740.9	169,970.0	166,980.0	145,848.0	139,900.0
NA	61.4	NA	NA	1,730.0	1,750.0	13,130.0	1,500.0
82.1	82.7	155.9	131.1	675.0	646.0	5,607.0	5,183.0
1.9	1.2	12.3	11.0	31.6	16.5	271.7	164.4
1.1	1.2	13.6	13.5	5.4	4.1	123.0	134.6
[1]0.2	[1]0.2	6.7	6.7	NA	NA	NA	NA
0.3	0.4	5.2	1.9	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA
0.6	0.5	3.1	3.1	2.3	2.8	55.3	58.4
11.0	11.2	96.4	96.6	0.1	76.8	2,186.8	1,940.1
5.5	6.9	32.0	31.7	54.0	58.0	9,460.0	9,460.0
232.0	222.3	312.3	269.1	6,354.0	4,250.0	22,861.0	17,550.0
218.3	221.6	NA	NA	NA	NA	NA	NA
NA	1.6	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA
191.1	174.8	590.7	568.3	2,900.0	2,900.0	52.0	52.0
0.0	0.0	0.0	0.0	10.0	10.0	150.0	150.0
NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA
1.2	0.9	40.0	43.2	NA	NA	NA	NA

and other income only. 18. Changed fiscal yearend - contains 15 months. 19. As of fiscal yearend, Texaco Canada was purchased by Imperial Oil Ltd. 20. Net operating revenues. 21. Net sales. 22. Proved, developed, and undeveloped. 23. Based on working interest. 24. Oil and natural gas. 25. Net equity production. 26. Fields on stream only. 27. Changed fiscal yearend - contains 11 months only. 28. Excludes non operating income. 29. Developed and undeveloped. 30. Total assets minus current liabilities. 31. Fiscal yearend is June 30.

World 1989: Oil production, refining capacity, oil movements, reserves




Asia-Pacific
Oil-22,545
Production-3,214
Gas-248.0
U.S.S.R., China, and other CPE's
Oil-84,100
Production-15,311
Gas-1,563.3
Middle East
Production-16,031
Gas-1,226.3
Oil reserves-million bbl
Gas reserves-trillion cubic ft (tcf)
Production and refining capacity-thousand b/d
Exports from
Latin America
Western Europe
Asia-Pacific
100
200
628
275
2,100
650
85
25
950
190
10
35
11
8
225
15
85
5
680
80
9
160
165
5
250
50
95
20
Exports from
U.S.
Canada

Worldwide production statistics

NORTH AMERICA

Upper figures = 1,000 b/d
Lower figures = million t/y

	1940	1950	1960	1965	1970	1980	1982	1983	1984	1985	1986	1987	1988	1989
Canada	23.5	79.6	525.6	801.4	1,263.6	1,412.0	1,233.0	1,396.0	1,430.0	1,453.0	1,475.3	1,508.3	1,604.6	1,588.0
	1.2	4.0	26.2	39.9	62.9	70.3	61.4	69.5	71.2	72.4	73.5	75.1	79.9	79.1
United States	**3,707.4**	**5,407.1**	**7,054.6**	**7,804.1**	**9,630.0**	**8,569.0**	**8,655.0**	**8,669.0**	**8,750.0**	**8,919.0**	**8,790.0**	**8,276.7**	**8,165.9**	**7,675.6**
	184.6	**269.3**	**351.3**	**388.6**	**479.6**	**426.7**	**431.0**	**431.7**	**435.8**	**444.2**	**437.7**	**412.2**	**406.7**	**382.2**
Total	3,730.9	5,486.7	7,580.2	8,605.5	10,893.6	9,981.0	9,888.0	10,065.0	10,180.0	10,372.0	10,265.3	9,785.0	9,770.5	9,263.6
	185.8	273.3	377.5	428.5	542.5	497.0	492.4	501.2	507.0	516.6	511.2	487.3	486.6	461.3

MIDDLE EAST

Upper figures = 1,000 b/d
Lower figures = million t/y

	1940	1950	1960	1965	1970	1980	1982	1983	1984	1985	1986	1987	1988	1989
Abu Dhabi				281.9	693.8	1,350.0	883.0	757.0	750.0	705.1	949.0	969.4	1,012.6	1,359.0
				14.0	34.6	67.2	44.0	37.7	37.4	35.1	47.3	48.3	50.4	67.7
Bahrain	**19.3**	**30.2**	**45.1**	**57.0**	**76.6**	**48.0**	**45.0**	**41.0**	**41.0**	**41.9**	**44.0**	**43.2**	**42.3**	**42.2**
	1.0	**1.5**	**2.2**	**2.8**	**3.8**	**2.4**	**2.2**	**2.0**	**2.0**	**2.1**	**2.2**	**2.2**	**2.1**	**2.1**
Dubai						349.0	357.0	327.0	324.0	348.0	350.0	381.2	355.3	410.6
						17.4	17.8	16.3	16.1	17.3	17.4	19.0	17.7	20.4
Iran	**181.2**	**664.3**	**1,067.6**	**1,885.5**	**3,328.8**	**1,467.0**	**1,896.0**	**2,606.0**	**2,166.0**	**2,279.0**	**1,806.3**	**2,341.7**	**2,207.5**	**2,934.3**
	9.0	**33.1**	**53.2**	**93.9**	**165.8**	**73.1**	**94.4**	**129.8**	**107.9**	**113.5**	**90.0**	**116.6**	**109.9**	**146.1**
Iraq	60.7	136.2	1,004.2	1,315.2	1,548.6	2,638.0	914.0	905.0	1,218.0	1,396.8	1,787.7	2,095.8	2,679.2	2,830.0
	3.0	6.8	50.0	65.5	77.1	131.4	45.5	45.1	60.7	69.6	89.0	104.4	133.4	140.9
Israel	...	...	**2.5**	**4.0**	**70.2**	**1.0**	**0.3**	**0.2**	**0.1**	**0.1**	**0.1**	**1.0**	**0.3**	**0.3**
	...	...	**0.1**	**0.2**	**3.5**	...	...	...	...	...	...	...	...	...
Jordan												4.0	0.5	0.3
												0.2		
Kuwait	...	**344.4**	**1,628.2**	**2,169.5**	**2,734.5**	**1,382.0**	**675.0**	**912.0**	**925.0**	**823.3**	**1,202.0**	**1,095.8**	**1,254.2**	**1,542.6**
	...	**17.2**	**81.1**	**108.0**	**136.2**	**68.8**	**33.6**	**45.4**	**46.1**	**41.0**	**59.9**	**54.6**	**62.5**	**76.8**
Neutral Zone			136.2	360.9	500.6	540.0	315.0	398.0	420.0	357.8	325.7	399.2	316.3	396.6
			6.8	18.0	24.9	26.9	15.7	19.8	20.9	17.8	16.2	19.9	15.8	19.8
Oman	...	...	...	...	**332.4**	**283.0**	**328.0**	**378.0**	**404.0**	**484.3**	**540.8**	**565.0**	**596.7**	**622.7**
	...	...	...	...	**16.6**	**14.1**	**16.3**	**18.8**	**20.1**	**24.1**	**26.9**	**28.1**	**29.7**	**31.0**
Qatar		33.6	175.1	231.1	362.4	472.0	340.0	270.0	395.0	297.0	332.3	284.4	349.2	394.6
		1.7	8.7	11.5	18.0	23.5	16.9	13.4	19.7	14.8	16.5	14.2	17.4	19.7
Ras Al Khaimah	...	...	...	...	...	...	...	...	**5.8**	**9.1**	**11.0**	**10.0**	**10.0**	**10.0**
	...	...	...	...	...	...	...	...	**0.3**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**
Saudi Arabia	13.9	546.7	1,247.1	2,024.9	3,548.9	9,630.0	6,484.0	4,872.0	4,545.0	3,295.3	4,719.7	4,054.2	4,708.3	4,935.6
	0.7	27.2	62.1	100.8	176.7	479.6	322.9	242.6	226.3	164.1	235.0	201.9	234.5	245.8
Sharjah	...	...	...	...	...	**10.0**	**7.0**	**35.0**	**62.0**	**66.1**	**65.0**	**66.9**	**65.0**	**65.0**
	...	...	...	...	...	**0.5**	**0.3**	**1.7**	**3.1**	**3.3**	**3.2**	**3.3**	**3.2**	**3.2**
Syria					83.1	165.0	175.0	165.0	161.0	161.7	185.0	231.7	273.3	300.6
					4.1	8.2	8.7	8.2	8.0	8.1	9.2	11.5	13.6	15.0
Turkey	...	**0.3**	**7.0**	**29.7**	**67.9**	**44.0**	**45.0**	**45.0**	**41.0**	**41.5**	**46.8**	**52.0**	**50.0**	**55.5**
	...	...	**0.3**	**1.5**	**3.4**	**2.2**	**2.2**	**2.2**	**2.0**	**2.1**	**2.3**	**2.6**	**2.5**	**2.8**
Yemen, North											10.0	10.0	159.9	176.6
											0.5	0.5	8.0	8.8
Yemen, South	...	...	...	...	...	...	...	...	...	...	...	...	**12.5**	**10.0**
	...	...	...	...	...	...	...	...	...	...	...	...	**0.6**	**0.5**
Total	275.1	1,755.7	5,313.0	8,359.7	13,347.8	18,379.0	12,464.3	11,711.2	11,457.9	10,307.0	12,375.4	12,605.5	14,093.1	16,086.5
	13.7	87.5	264.5	416.2	664.7	915.3	620.5	583.0	570.6	513.4	616.1	627.8	701.8	801.1

EUROPE

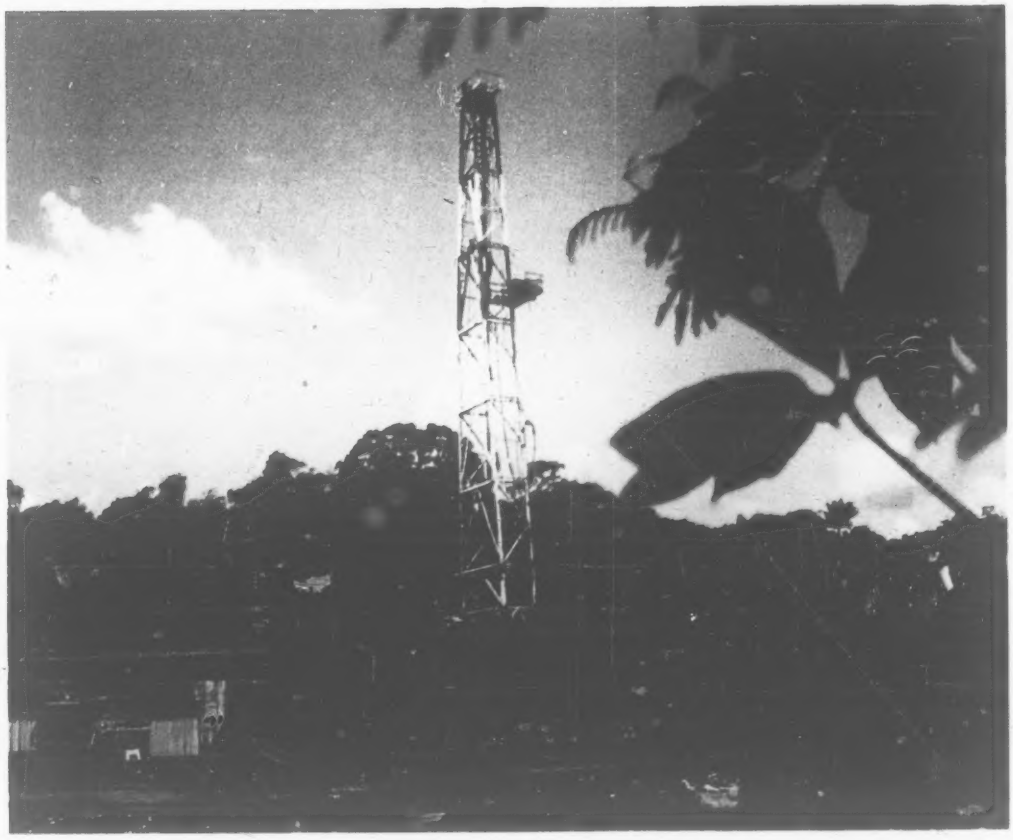
Upper figures = 1,000 b/d
Lower figures = million t/y

	1940	1950	1960	1965	1970	1980	1982	1983	1984	1985	1986	1987	1988	1989
Austria	7.7	27.9	45.4	53.1	53.3	29.0	25.0	24.0	23.0	21.7	22.2	21.6	23.2	23.3
	0.4	1.4	2.3	2.6	2.7	1.4	1.2	1.2	1.1	1.1	1.1	1.1	1.2	1.2
Denmark	...	...	...	...	...	**6.0**	**38.0**	**46.0**	**45.0**	**58.0**	**74.7**	**94.0**	**95.5**	**111.0**
	...	...	...	...	...	**0.3**	**1.9**	**2.3**	**2.2**	**2.9**	**3.7**	**4.7**	**4.8**	**5.5**
France	1.4	2.5	38.6	59.5	45.8	26.0	33.0	32.0	35.0	49.0	59.0	63.5	68.7	65.3
	0.1	0.1	1.9	3.0	2.3	1.3	1.6	1.6	1.7	2.4	2.9	3.2	3.4	3.3
Germany, Fed. Rep.	20.1	22.2	107.3	155.0	147.2	90.0	84.0	81.0	79.0	80.5	80.0	73.8	77.9	74.7
	1.0	1.1	5.3	7.7	7.3	4.5	4.2	4.0	3.9	4.0	4.0	3.7	3.9	3.7
Greece							21.0	25.0	27.0	26.4	26.4	24.4	21.8	17.0
							1.0	1.2	1.3	1.3	1.3	1.2	1.1	0.8
Italy	0.2	0.2	37.5	47.0	26.3	39.0	28.0	37.0	45.0	41.7	49.0	50.0	92.9	94.7
	...	...	1.9	2.3	1.3	1.9	1.4	1.8	2.2	2.1	2.4	2.5	4.6	4.7
Netherlands	13.4	36.0	37.0	35.8	25.0	28.0	42.0	61.0	69.0	79.0	91.3	83.7	87.0	
	0.7	1.8	1.8	1.8	1.2	1.4	2.1	3.0	3.4	3.9	4.5	4.2	4.3	
Norway	...	...	...	...	...	**528.0**	**488.0**	**600.0**	**688.0**	**771.0**	**823.3**	**973.3**	**1,069.1**	**1,469.8**
	...	...	...	...	...	**26.3**	**24.3**	**29.9**	**34.3**	**38.4**	**41.0**	**48.5**	**53.2**	**73.2**
Spain					3.1	32.0	30.0	59.0	45.0	45.3	37.2	32.8	30.4	18.0
					0.2	1.6	1.5	2.9	2.2	2.3	1.9	1.6	1.5	0.9
United Kingdom	0.3	0.9	1.7	1.7	1.7	**1,619.0**	**2,050.0**	**2,260.0**	**2,452.0**	**2,519.8**	**2,602.0**	**2,445.9**	**2,376.3**	**1,743.0**
	...	...	0.1	0.1	0.1	**80.6**	**102.1**	**112.5**	**122.1**	**125.5**	**129.6**	**121.8**	**118.3**	**86.8**
Total	29.7	67.1	266.5	353.3	313.2	2,394.0	2,825.0	3,206.0	3,500.0	3,682.4	3,852.8	3,870.6	3,939.5	3,703.8
	1.5	3.3	13.3	17.5	15.7	119.1	140.6	159.5	174.0	183.4	191.8	192.8	196.2	184.4

ASIA-PACIFIC

Upper figures = 1,000 b/d
Lower figures = million t/y

	1940	1950	1960	1965	1970	1980	1982	1983	1984	1985	1986	1987	1988	1989
Australia				7.2	175.6	379.0	353.0	405.0	481.0	556.0	472.0	566.1	552.3	488.8
				0.4	8.7	18.9	17.6	20.2	24.0	27.7	23.5	28.2	27.5	24.3
Bangladesh	...	...	...	...	...	...	...	...	...	...	...	0.5	0.9	0.9
	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Brunei	19.3	84.8	92.9	80.4	148.0	230.0	155.0	155.0	160.0	149.5	170.0	133.7	138.3	143.3
	1.0	4.2	4.6	4.0	7.4	11.5	7.7	7.7	8.0	7.4	8.5	6.7	6.9	7.1
Burma	21.1	1.5	11.1	12.1	16.4	30.0	30.0	30.0	30.0	30.0	30.0	24.0	15.0	12.0
	1.1	0.1	0.6	0.6	0.8	1.5	1.5	1.5	1.5	1.5	1.5	1.2	0.7	0.6
China, Taiwan			0.4	0.4	1.8	5.0	3.0	2.3	2.6	2.7	1.9	2.6	2.6	2.6
					0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
India	3.9	5.1	9.0	61.8	138.6	182.0	384.0	390.0	543.0	614.0	622.7	608.7	631.8	673.3
	0.2	0.3	0.4	3.1	6.9	9.1	19.1	19.4	27.0	30.6	31.0	30.3	31.5	33.5
Indonesia	169.4	132.6	411.2	485.0	853.6	1,576.0	1,341.0	1,292.0	1,332.0	1,219.5	1,243.8	1,185.8	1,337.5	1,208.6
	8.4	6.6	2.05	24.2	42.5	78.5	66.8	64.3	66.3	60.7	61.9	59.1	56.6	60.2
Japan	7.2	5.6	10.2	11.4	16.3	10.0	6.0	6.9	6.4	10.0	12.8	12.1	12.3	11.3
	0.4	0.3	0.5	0.6	0.8	0.5	0.3	0.3	0.3	0.5	0.6	0.6	0.6	0.6
Malaysia						288.0	306.0	370.0	462.0	432.8	503.3	467.4	540.0	557.3
						14.3	15.2	18.4	23.0	21.6	25.1	23.3	26.9	27.8
New Guinea	...	4.8	4.2	...	...	...	...	...	...	...	...	...	...	...
	...	0.2	0.2	...	...	...	...	...	...	...	...	...	...	...
New Zealand						7.0	15.0	15.0	18.0	18.0	29.3	28.3	28.0	28.0
						0.3	0.7	0.7	0.9	0.9	1.5	1.4	1.4	1.4
Pakistan	2.4	3.5	7.2	11.2	9.9	10.0	12.0	13.0	18.0	34.3	41.0	41.6	47.0	45.0
	0.1	0.2	0.4	0.6	0.5	0.5	0.6	0.6	0.9	1.7	2.0	2.1	2.3	2.2
Philippines						15.0	7.0	15.0	12.0	9.3	6.3	5.1	9.2	4.0
						0.7	0.3	0.7	0.6	0.5	0.3	0.3	0.5	0.2
Thailand	...	...	...	...	0.4	...	6.0	11.0	19.0	34.3	35.6	31.3	38.4	39.0
	...	...	...	...	...	...	0.3	0.5	0.9	1.7	1.8	1.6	1.9	1.9
Total	223.3	237.9	546.2	669.5	1,360.6	2,732.0	2,618.0	2,705.2	3,084.0	3,110.4	3,168.7	3,107.2	3,153.3	3,214.1
	11.2	11.9	27.2	33.5	67.7	136.0	130.2	134.4	153.5	154.9	157.8	154.9	156.9	159.9



AN Ecuadorian State Oil Corporation production well in the Amazon region.

AFRICA

Upper figures: 1,000 b/d
Lower figures: million t/y

	1940	1950	1960	1965	1970	1980	1982	1983	1984	1985	1986	1987	1988	1989
Algeria			182.7 9.1	551.6 27.5	1,029.1 51.2	1,016.0 50.6	750.0 37.4	686.6 34.2	608.0 30.3	643.3 32.0	600.7 29.9	647.9 32.3	666.8 33.2	698.0 34.8
Angola (inc. Cabinda)	... ...	... ...	1.3 0.1	13.0 0.6	13.7 0.7	150.0 7.5	122.0 6.1	174.0 8.7	207.0 10.3	228.5 11.4	280.7 14.0	341.3 17.0	449.3 22.4	454.7 22.6
Cameroon						58.0 2.9	109.0 5.4	114.0 5.7	125.0 6.2	133.5 6.6	180.0 9.0	170.0 8.5	170.0 8.5	172.7 8.6
Congo	... ...	... ...	... ...	... ...	... ...	56.0 2.8	87.0 4.3	95.0 4.7	118.0 5.9	115.1 5.7	115.0 5.7	118.0 5.9	134.8 6.7	150.0 7.5
Egypt	18.1 0.9	44.9 2.2	61.6 3.1	122.7 6.1	327.3 16.3	596.0 29.7	667.0 33.2	690.0 34.4	790.0 39.3	885.8 44.1	773.7 38.5	899.3 44.8	851.3 42.4	854.3 42.5
Gabon	... ...	... ...	16.1 0.8	25.2 1.3	108.8 5.4	180.0 9.0	130.0 6.5	150.0 7.5	150.0 7.5	150.0 7.5	146.2 7.3	155.8 7.8	175.0 8.7	197.3 9.8
Ivory Coast							9.0 0.4	24.0 1.2	22.0 1.1	28.0 1.4	20.0 1.0	16.0 0.8	12.9 0.6	2.0 0.1
Libya	... ...	... ...	... ...	1,220.0 60.8	3,318.0 165.2	1,785.0 88.9	1,127.0 56.1	1,020.0 50.8	1,090.0 54.3	1,045.3 52.1	1,030.7 51.3	1,019.7 50.8	1,012.5 50.4	1,100.6 54.8
Nigeria			17.3 0.9	272.2 13.6	1,083.3 53.9	2,057.0 102.4	1,324.0 65.9	1,232.0 61.4	1,414.0 70.4	1,445.5 72.0	1,464.0 72.9	1,238.6 61.7	1,358.3 67.6	1,605.3 79.9
Tunisia	... ...	... ...	3.0 0.1	3.6 0.2	87.7 4.4	110.0 5.5	106.0 5.3	115.0 5.7	114.0 5.7	125.0 6.2	106.0 5.3	104.3 5.2	102.8 5.1	102.0 5.1
Zaire						20.0 1.0	22.0 1.1	26.0 1.3	27.0 1.3	30.5 1.5	32.1 1.6	31.8 1.6	29.5 1.5	27.5 1.4
Others	... ...	0.8 ...	3.0 0.1	3.6 0.2	1.5 0.1	4.0 0.2	1.7 0.1	6.6 0.3	7.7 0.4	8.9 0.4	7.6 0.4	12.3 0.6	5.0 0.2	4.8 0.2
Total	18.1 0.9	45.7 2.2	285.0 14.2	2,211.9 110.3	5,969.4 297.2	6,032.0 300.5	4,454.7 221.8	4,333.2 215.9	4,672.7 232.7	4,839.4 240.9	4,756.7 236.9	4,755.0 237.0	4,968.2 247.3	5,369.2 267.3

LATIN AMERICA

Upper figures: 1,000 b/d
Lower figures: million t/y

	1940	1950	1960	1965	1970	1980	1982	1983	1984	1985	1986	1987	1988	1989
Argentina	56.3 2.8	64.0 3.2	171.9 8.6	269.3 13.4	382.9 19.1	487.0 24.3	483.0 24.1	481.0 24.0	467.0 23.3	447.5 22.3	430.2 21.4	419.1 20.9	449.6 22.4	459.0 22.9
Bolivia	0.8 ...	1.7 0.1	9.8 0.5	9.2 0.5	16.3 0.8	30.0 1.5	24.0 1.2	22.0 1.1	20.0 1.0	20.0 1.0	18.7 0.9	18.5 0.9	18.8 0.9	20.3 1.0
Brazil		0.9	80.9 4.0	94.0 4.7	160.5 8.0	182.0 9.1	252.0 12.5	315.0 15.7	437.0 21.8	540.5 26.9	578.0 28.8	562.8 28.0	555.6 27.7	597.1 29.7
Chile	... ...	1.7 0.1	19.8 1.0	34.9 1.7	34.6 1.7	29.0 1.4	41.0 2.0	39.0 1.9	38.0 1.9	32.5 1.6	34.4 1.7	28.3 1.4	24.8 1.2	23.7 1.2
Colombia	69.9 3.5	93.3 4.6	152.7 7.6	210.0 10.5	214.0 10.7	125.0 6.2	140.0 7.0	155.0 7.7	165.0 8.2	178.8 8.9	324.2 16.1	387.8 19.3	346.7 17.3	405.0 20.2
Ecuador	6.4 0.3	7.2 0.4	7.7 0.4	8.0 0.4	4.1 0.2	222.0 11.1	215.0 10.7	236.0 11.8	254.0 12.6	273.3 13.6	270.1 13.5	157.2 7.8	310.1 15.4	286.6 14.3
Guatemala						5.0 0.2	6.4 0.3	7.5 0.4	5.2 0.3	3.1 0.2	4.9 0.2	3.9 0.2	3.7 0.2	3.7 0.2
Mexico	120.3 6.0	198.5 9.9	270.6 13.5	323.1 16.1	430.2 21.4	1,936.0 96.4	2,734.0 136.2	2,702.0 134.6	2,743.0 136.6	2,797.0 139.3	2,468.0 122.9	2,537.8 126.4	2,527.3 125.9	2,618.0 130.4
Peru	33.2 1.7	41.1 2.0	52.6 2.6	63.2 3.1	72.2 3.6	191.0 9.5	198.0 9.9	171.0 8.5	201.0 10.0	189.0 9.4	179.0 8.9	166.7 8.3	141.7 7.1	129.0 6.4
Trinidad & Tobago	60.9 3.0	56.5 2.8	115.7 5.8	133.9 6.7	139.8 7.0	211.0 10.5	182.0 9.1	158.0 7.9	169.0 8.4	179.0 8.9	167.9 8.4	163.1 8.1	149.3 7.4	153.7 7.7
Venezuela	507.0 25.2	1,498.0 74.6	2,846.1 141.7	3,472.9 173.0	3,708.0 184.7	2,167.0 107.9	1,826.0 90.9	1,791.0 89.2	1,724.0 85.9	1,669.0 83.1	1,664.9 82.9	1,591.9 79.3	1,658.0 82.6	1,731.6 86.2
Others	... ...	... ...	... ...	... ...	... ...	... ...	0.6 ...	0.5 ...	2.2 0.1	2.9 0.1	3.6 0.2	3.6 0.2	3.7 0.2	4.9 0.2
Total	854.8 42.5	1,962.9 97.7	3,727.8 185.7	4,618.5 230.1	5,162.6 257.2	5,585.0 278.1	6,102.0 303.9	6,078.0 302.8	6,225.4 310.1	6,332.6 315.3	6,143.9 305.9	6,040.7 300.8	6,189.3 308.3	6,432.6 320.4
Total non-Communist	**5,131.9 255.6**	**9,556.0 475.9**	**17,718.7 882.4**	**24,818.4 1,236.1**	**37,047.7 1,845.0**	**45,103.0 2,246.0**	**38,352.0 1,909.4**	**38,094.6 1,896.8**	**39,120.0 1,947.9**	**38,843.8 1,924.5**	**40,562.8 2,019.7**	**40,184.0 2,000.8**	**42,113.9 2,097.1**	**44,069.8 2,194.4**

COMMUNIST AREAS

Upper figures: 1,000 b/d
Lower figures: million t/y

	1940	1950	1960	1965	1970	1980	1982	1983	1984	1985	1986	1987	1988	1989
Bulgaria			4.0 0.2	4.6 0.2	6.7 0.3	6.0 0.3	3.0 0.1	3.0 0.1	3.0 0.1	3.0 0.1	4.0 0.1	6.0 0.2	6.0 0.2	5.0 0.2
China	... ...	4.0 0.2	100.0 5.0	220.0 11.0	500.0 24.9	2,119.0 105.5	2,042.0 101.7	2,120.0 105.6	2,250.0 112.1	2,496.0 124.3	2,620.0 130.5	2,700.0 134.5	2,733.0 136.1	2,770.0 137.9
Czechoslovakia		0.8	2.7 0.1	3.9 0.2	4.1 0.2	1.9 0.1	2.0 0.1	2.0 0.1	2.0 0.1	2.0 0.1	2.0 0.1	2.0 0.1	3.0 0.1	3.0 0.1
German Dem. Rep.*	... ...	1.0 ...	1.0 ...	1.0 ...	1.2 0.1	10.0 0.5	10.0 0.5	10.0 0.5	10.0 0.5	10.0 0.5	10.0 0.5	10.0 0.5	8.0 0.4	7.0 0.3
Hungary		10.1 0.5	24.3 1.2	36.1 1.8	38.7 1.9	40.6 2.0	41.0 2.0	40.0 2.0	40.0 2.0	40.0 2.0	40.0 2.0	40.0 2.0	40.0 2.0	39.0 1.9
Poland	... ...	3.3 0.2	3.9 0.2	6.8 0.3	8.5 0.4	6.6 0.3	4.0 0.2	5.0 0.2	5.0 0.2	5.0 0.2	4.0 0.2	4.0 0.2	4.0 0.2	3.0 0.1
Romania		87.7 4.4	231.0 11.5	252.4 12.6	268.6 13.4	230.9 11.5	234.0 11.7	240.0 12.0	229.0 11.4	226.0 11.3	220.0 11.0	215.0 10.7	188.0 9.4	180.0 9.0
U.S.S.R.*	624.9 31.1	760.6 37.9	2,969.1 147.9	4,877.3 242.9	7,089.2 353.0	12,031.0 599.1	12,260.0 610.5	12,320.0 613.5	12,260.0 610.5	11,900.0 592.6	12,300.0 612.5	12,480.0 621.5	12,452.0 620.1	12,140.0 604.6
Yugoslavia	0.3	2.1 0.1	18.8 0.9	40.7 2.0	57.8 2.9	84.5 4.2	87.0 4.3	82.0 4.1	80.0 4.0	81.0 4.0	83.0 4.1	84.0 4.2	73.0 3.6	70.0 3.5
Others	... ...	2.7 0.1	14.9 0.7	19.0 0.9	37.1 1.8	50.0 2.5	81.0 4.0	86.0 4.3	96.0 4.8	86.0 4.3	77.0 3.8	80.0 4.0	85.0 4.2	86.0 4.3
Total	625.2 31.1	872.3 43.4	3,369.7 167.7	5,461.8 271.9	8,011.9 398.9	14,580.5 726.0	14,764.0 735.1	14,908.0 742.4	14,975.0 745.7	14,849.0 739.4	15,359.0 764.8	15,621.0 778.0	15,591.0 776.3	15,303.0 761.9
*Includes gas liquids														
World Total	5,757.1 286.7	10,428.3 519.3	21,088.4 1,050.1	30,280.2 1,508.0	45,059.1 2,243.9	59,683.5 2,972.0	53,116.0 2,644.5	53,006.6 2,873.4	54,095.0 2,693.6	53,492.8 2,663.9	55,921.8 2,784.5	55,785.0 2,778.6	57,704.9 2,873.4	59,372.8 2,956.3

MOTORISTS continue to fill their tanks in increasing volumes around the world.

Worldwide oil consumption

Upper figures: 1,000 b/d
Lower figures: million t/y

	1986	1987	1988
U.S.A.	15,670 751.3	15,955 763.4	16,420 789.2
Canada	1,475 68.1	1,540 71.4	1,615 74.7
Total North America	17,145 819.4	17,495 834.8	18,035 863.9
Latin America	4,530 215.3	4,740 224.1	4,825 228.1
Total Western Hemisphere	21,675 1,034.7	22,235 1,058.9	22,860 1,092.0
Austria	215 10.4	220 10.7	220 10.6
Belgium & Luxembourg	485 23.5	490 23.7	500 24.3
Denmark	215 10.5	200 9.6	195 9.5
Finland	230 11.3	230 11.2	230 11.0
France	1,830 86.0	1,845 86.6	1,820 85.7
Germany, Fed. Rep.	2,530 119.9	2,445 115.2	2,435 114.8
Greece	250 12.2	270 13.2	285 14.1
Ireland	100 4.8	85 4.1	80 3.8
Italy	1,770 86.5	1,850 90.1	1,880 91.7
Netherlands	700 32.4	705 32.4	740 34.4
Norway	200 9.3	215 9.7	205 9.3
Portugal	195 9.5	190 8.9	175 8.0
Spain	925 42.7	925 43.8	930 45.0
Sweden	385 18.7	355 17.1	345 16.6
Switzerland	280 13.2	265 12.4	265 12.4
Turkey	375 18.3	435 21.0	460 22.3
United Kingdom	1,645 77.4	1,610 75.2	1,705 80.0
Other	50 2.5	55 2.8	60 3.1
Total Western Europe	12,380 589.1	12,390 587.7	12,530 596.6
Middle East	2,660 127.8	2,705 130.1	2,815 135.4
Africa	1,695 81.8	1,775 85.3	1,795 86.2
South Asia	1,210 58.5	1,260 61.0	1,370 66.3
Southeast Asia	2,395 116.2	2,545 123.4	2,890 140.6
Japan	4,435 205.3	4,435 205.7	4,760 222.2
Australasia	695 32.2	730 33.0	745 34.3
U.S.S.R.	8,930 444.7	8,920 444.2	8,890 439.1
Eastern Europe	2,560 125.2	2,535 123.9	2,555 125.1
China	1,820 89.7	1,925 95.2	2,035 100.7
Total Eastern Hemisphere	38,780 1,870.5	39,220 1,889.5	40,385 1,946.5
World excl. U.S.S.R. China & E. Europe	47,145 2,245.6	48,075 2,285.1	49,765 2,373.6
World Total	60,455 2,905.2	61,455 2,948.4	63,245 3,038.5

Source: British Petroleum
South Asia—Afghanistan, Bangladesh, Burma, India, Nepal, Pakistan, Sri Lanka. Southeast Asia—Brunei, Malaysia, Indonesia, Hong Kong, South Korea, Philippines, Singapore, Thailand, Taiwan, Papua New Guinea, SW Pacific Islands. Australasia—Australia, New Zealand

Worldwide refining capacity

EUROPE

	1940	1950	1960	1970	1980	1982	1983	1984	1985	1986	1987	1988	1989	1990
Austria		16 1.3	47 2.4	98 4.9	296 13.9	248 12.2	269 13.4	268 13.3	276 13.6	204 10.2	204 10.2	204 10.2	204 10.2	204 10.2
Belgium	12 0.6	16 0.8	171 8.5	699 34.8	1,064 53.0	1,035 51.5	693 34.5	694 34.6	693 34.5	652 32.5	648 32.3	631 31.4	631 31.4	614 30.6
Cyprus					16 0.8	16 0.8	16 0.8	15 0.7	16 0.8	16 0.8	16 0.8	16 0.8	17 0.8	19 0.9
Denmark	1 —	1 —	— —	173 8.6	214 10.7	215 10.7	215 10.7	174 8.7	176 8.8	166 8.3	166 8.3	177 8.8	177 8.8	187 9.3
Finland			25 1.2	176 8.8	336 16.7	299 14.9	299 14.9	299 14.9	299 14.9	241 12.0	241 12.0	241 12.0	241 12.0	241 12.0
France	152 7.6	306 15.2	769 38.3	2,405 119.8	3,385 168.6	3,291 163.9	2,871 143.0	2,670 133.0	2,386 118.8	1,947 97.0	1,834 91.3	1,941 96.7	1,876 93.4	1,820 90.6
Germany, Fed. Rep.	48 2.4	81 4.0	573 28.5	2,352 117.1	2,986 148.7	2,937 146.3	2,471 123.1	2,386 118.8	2,172 108.2	1,933 96.3	1,720 85.7	1,648 82.1	1,518 75.6	1,603 79.8
Greece	— —	— —	30 1.5	95 4.7	431 21.5	427 21.3	422 21.0	369 18.4	390 19.4	390 19.4	385 19.2	385 19.2	385 19.2	385 19.2
Ireland	20 0.5		40 2.0	54 2.7	56 2.8	56 2.8	56 2.8	56 2.8	56 2.8	56 2.8	56 2.8	56 2.8	56 2.8	56 2.8
Italy	41 2.0	107 5.3	773 38.5	3,214 160.1	4,131 205.7	4,003 199.3	3,283 163.5	3,050 151.9	3,095 154.1	2,738 136.4	2,679 133.4	2,563 127.6	2,450 122.0	2,804 139.6
Netherlands	18 0.9	70 3.5	459 17.9	2,456 72.5	1,828 91.0	1,798 89.1	1,552 77.3	1,552 77.3	1,499 74.7	1,468 73.1	1,401 69.8	1,381 68.8	1,381 68.8	1,381 68.8
Norway	1 —	1 —	2 0.1	113 5.6	264 13.1	243 12.1	243 12.1	243 12.1	244 12.2	240 12.0	240 12.0	240 12.0	239 11.9	295 14.7
Portugal	4 0.2	8 0.4	23 1.1	82 4.1	376 18.8	368 18.2	368 18.2	282 14.0	290 14.4	296 14.7	294 14.6	294 14.6	313 15.6	317 15.8
Spain	11 0.5	17 0.8	144 7.2	734 36.6	1,455 72.5	1,517 75.5	1,522 75.8	1,493 74.4	1,493 74.4	1,367 68.1	1,305 65.0	1,305 65.0	1,285 64.0	1,293 64.4
Sweden	4 0.2	26 1.3	48 2.4	253 12.6	458 22.8	471 23.5	454 22.6	454 22.6	439 21.9	429 21.4	437 21.8	437 21.8	427 21.3	429 21.4
Switzerland	— —	— —	— —	106 5.3	137 6.8	137 6.8	137 6.8	137 6.8	127 6.3	137 6.8	65 3.2	132 6.6	132 6.6	132 6.6
United Kingdom	133 6.6	197 9.8	962 47.9	2,420 120.5	2,527 125.8	2,482 123.6	2,260 112.5	2,092 104.2	2,007 99.9	1,792 89.2	1,780 88.6	1,803 89.8	1,803 89.8	1,951 97.2
Yugoslavia	5 0.2	8 0.4	10 0.5	228 11.4	296 14.7	297 14.8	297 14.8	297 14.8	297 14.8	302 15.0	483 24.1	608 30.3	609 30.3	609 30.3
Total Europe	438 21.5	871 43.1	3,976 197.9	14,657 730.1	20,242 1,007.9	19,743 983.3	17,424 867.8	16,530 823.3	15,952 794.5	14,374 716.0	13,954 695.1	14,062 700.5	13,744 684.5	14,118 703.1

NORTH AMERICA

	1940	1950	1960	1970	1980	1982	1983	1984	1985	1986	1987	1988	1989	1990
Canada	203 10.1	329 16.4	1,062 49.5	1,355 67.5	2,202 110.7	2,200 109.6	2,020 100.6	1,807 90.0	1,869 93.1	1,856 92.4	1,760 87.6	1,869 93.1	1,859 92.4	1,892 94.2
United States	4,460 222.1	6,696 333.5	10,400 517.9	12,079 601.5	17,720 882.5	18,700 931.3	16,800 836.6	15,930 793.3	15,400 766.9	15,182 756.1	15,258 759.8	15,288 761.3	15,557 774.7	16,244 809.0
Total	4,663 232.2	7,025 349.9	11,402 567.8	13,434 669.0	19,942 993.2	20,900 1,040.9	18,820 937.2	17,737 883.3	17,269 860.0	17,038 848.5	17,018 847.4	17,157 854.4	17,413 867.1	18,096 901.2

LATIN AMERICA

Upper figures = 1,000 b/d
Lower figures = million t/y

	1940	1950	1960	1970	1980	1982	1983	1984	1985	1986	1987	1988	1989	1990
Argentina	103 5.1	152 7.6	238 11.9	502 25.0	676 33.7	677 33.7	676 33.7	678 33.8	678 33.8	667 33.2	670 33.4	690 34.4	690 34.4	689 34.3
Bahamas	... ...	... ...	... ...	... ...	500 24.9	500 24.9	500 24.9	500 24.9	350 17.4	... ...	... ...	... ...	... ...	... ...
Barbados				3 0.1	3 0.1	3 0.1	3 0.1	3 0.1	3 0.1	3 0.1	3 0.1	3 0.1	3 0.1	3 0.1
Bolivia	1 ...	7 0.3	12 0.6	21 1.0	74 3.7	61 3.0	61 3.0	47 2.3	47 2.3	47 2.3	47 2.3	47 2.3	58 2.9	58 2.9
Brazil	4 0.2	12 0.6	156 7.8	575 28.6	1,205 60.0	1,407 70.1	1,219 60.7	1,301 64.8	1,305 65.0	1,305 65.0	1,321 65.8	1,407 70.1	1,407 70.1	1,397 69.6
Chile	1 ...	4 0.2	24 1.2	115 5.7	139 6.9	141 7.0	141 7.0	141 7.0	141 7.0	141 7.0	150 7.5	141 7.0	147 7.3	147 7.3
Colombia	15 0.7	24 1.2	51 2.5	140 7.0	193 9.6	199 9.9	214 10.7	211 10.5	211 10.5	211 10.5	226 11.3	226 11.3	227 11.3	227 11.3
Costa Rica	... ...	... ...	... ...	8 0.4	11 0.5	15 0.7	16 0.8	17 0.8	16 0.8	15 0.7	16 0.8	16 0.8	16 0.8	16 0.8
Cuba	4 0.2	7 0.3	87 4.3	93 4.6	160 8.0	160 8.0	160 8.0	160 8.0	160 8.0	160 8.0	160 8.0	160 8.0	160 8.0	160 8.0
Ecuador	2 0.1	5 0.2	7 0.3	37 1.8	86 4.3	90 4.5	79 3.9	84 4.2	82 4.1	88 4.4	88 4.4	122 6.1	123 6.1	145 7.2
El Salvador				14 0.7	16 0.8	16 0.8	16 0.8	16 0.8	16 0.8	16 0.8	17 0.8	17 0.8	17 0.8	17 0.8
Guatemala	... ...	... ...	... ...	21 1.0	16 0.8	16 0.8	16 0.8	16 0.8	16 0.8	16 0.8	16 0.8	16 0.8	16 0.8	16 0.8
Honduras				10 0.5	14 0.7	14 0.7	14 0.7	14 0.7	14 0.7	14 0.7	14 0.7	14 0.7	14 0.7	14 0.7
Jamaica	... ...	... ...	... ...	28 1.4	34 1.7	22 1.1	36 1.8	36 1.8	36 1.8	36 1.8	36 1.8	36 1.8	34 1.7	34 1.7
Mexico	98 4.9	160 8.0	357 17.8	515 25.6	1,394 69.4	1,470 73.2	1,289 64.2	1,269 63.2	1,269 63.2	1,269 63.2	1,349 67.2	1,354 67.4	1,354 67.4	1,514 75.4
Netherlands Antilles	495 24.7	617 30.7	680 33.9	795 39.6	792 39.4	782 38.9	782 38.9	740 36.9	740 36.9	320 15.9	320 15.9	320 15.9	320 15.9	320 15.9
Nicaragua				21 1.0	14 0.7	14 0.7	14 0.7	15 0.7	15 0.7	15 0.7	15 0.7	15 0.7	15 0.7	15 0.7
Panama	... ...	... ...	... ...	140 7.0	100 5.0	100 5.0	100 5.0	100 5.0	100 5.0	100 5.0	100 5.0	100 5.0	100 5.0	100 5.0
Paraguay				5 0.2	7 0.3	8 0.4	8 0.4	8 0.4	8 0.4	8 0.4	8 0.4	8 0.4	8 0.4	8 0.4
Peru	22 1.1	35 1.7	49 2.4	104 5.2	170 8.5	162 8.1	168 8.4	169 8.4	176 8.8	176 8.8	176 8.8	182 9.1	172 8.6	172 8.6
Puerto Rico			84 4.2	155 7.7	284 14.1	284 14.1	123 6.1	121 6.0	121 6.0	121 6.0	121 6.0	123 6.1	123 6.1	123 6.1
Trinidad & Tobago	49 2.4	104 5.2	182 9.1	417 20.8	456 22.7	456 22.7	375 18.7	375 18.7	320 15.9	260 12.9	300 14.9	300 14.9	300 14.9	300 14.9
Uruguay	5 0.2	16 0.8	28 1.4	40 2.0	40 2.0	45 2.2	45 2.2	45 2.2	45 2.2	45 2.2	45 2.2	45 2.2	33 1.6	33 1.6
Venezuela	55 2.7	254 12.6	886 44.1	1,324 65.9	1,446 72.0	1,323 65.9	1,284 63.9	1,224 61.0	1,224 61.0	1,230 61.3	1,225 61.0	1,201 59.8	1,201 59.8	1,201 59.8
Virgin Islands				220 11.0	728 36.3	640 31.9	600 29.9	600 29.9	545 27.1	600 29.9	600 29.9	545 27.1	545 27.1	545 27.1
Others	... ...	... ...	... ...	31 1.5	62 3.1	59 2.9	77 3.8	55 2.7	57 2.8	57 2.8	57 2.8	61 3.0	60 3.0	61 3.0
Total	854 42.3	1,397 69.4	2,841 141.5	5,334 265.3	8,620 429.2	8,664 431.3	8,016 399.1	7,945 395.6	7,695 383.1	6,920 344.4	7,080 352.5	7,149 355.8	7,143 355.5	7,315 364.0

CALTEX terminal on Tsing Yi Island, Hong Kong, is fully-automated facility that can store 1.2 million bbl of petroleum products and 3,000 tons of LP-gas.

ASIA-PACIFIC

Upper figures — 1,000 b/d
Lower figures — million t/y

	1940	1950	1960	1970	1980	1982	1983	1984	1985	1986	1987	1988	1989	1990
Australia	4 0.2	14 0.7	237 11.8	581 28.9	725 36.1	742 37.0	716 35.7	722 36.0	697 34.7	623 31.0	626 31.2	637 31.7	644 32.1	675 33.6
Bangladesh	... ...	... ...	... ...	... ...	**31** **1.5**	**31** **1.5**	**31** **1.5**	**22** **1.1**	**31** **1.5**	**31** **1.5**	**31** **1.5**	**31** **1.5**	**31** **1.5**	**31** **1.5**
Brunei-Malaysia-Singapore	10 0.5	10 0.5	46 2.3	302 15.0	1,093 54.4	1,271 63.3	1,271 63.3	1,313 65.4	1,286 64.0	1,240 61.8	1,183 58.9	1,080 53.8	1,071 53.3	1,049 52.2
Burma*	... ...	... ...	... ...	... ...	**26** **1.3**	**26** **1.3**	**26** **1.3**	**26** **1.3**	**26** **1.3**	**26** **1.3**	**26** **1.3**	**26** **1.3**	**26** **1.3**	**32** **1.6**
China, Taiwan			28 1.4	129 6.4	425 21.2	515 25.6	515 25.6	515 25.6	543 27.0	543 27.0	543 27.0	600 29.9	570 28.4	570 28.4
Guam*	... ...	... ...	... ...	... ...	**44** **2.2**	**44** **2.2**	**44** **2.2**	**44** **2.2**	**44** **2.2**	... ...	... ...	... ...	... ...	... ...
India	10 0.5	6 0.3	112 5.6	436 21.7	557 27.7	557 27.7	753 37.5	779 38.8	705 35.1	867 43.2	991 49.4	1,059 52.7	1,051 52.3	1,080 53.8
Indonesia	**170** **8.5**	**203** **10.1**	**274** **13.6**	**268** **13.3**	**528** **26.3**	**498** **24.8**	**341** **17.0**	**387** **19.3**	**631** **31.4**	**636** **31.7**	**636** **31.7**	**714** **35.6**	**714** **35.6**	**714** **35.6**
Japan	53 2.6	34 1.7	640 31.9	2,796 139.2	5,509 274.3	5,601 278.9	5,548 276.3	5,020 250.0	4,813 239.7	4,613 229.7	4,790 238.5	4,567 227.4	4,363 217.3	4,198 209.1
Korea, South	... ...	... ...	... ...	**175** **8.7**	**601** **29.9**	**755** **37.6**	**755** **37.6**	**776** **38.6**	**776** **38.6**	**782** **38.9**	**862** **42.9**	**820** **40.8**	**880** **43.8**	**867** **43.2**
New Zealand*					74 3.7	74 3.7	74 3.7	74 3.7	53 2.6	53 2.6	54 2.7	82 4.1	88 4.4	95 4.7
Okinawa*	... ...	... ...	... ...	... ...	**198** **9.9**	**208** **10.4**	**183** **9.1**	**153** **7.6**	**153** **7.6**	**110** **5.5**	... ...	... ...	... ...	... ...
Pakistan		5 0.2	6 0.3	115 5.7	98 4.9	133 6.6	133 6.6	126 6.3	129 6.4	130 6.5	130 6.5	130 6.5	130 6.5	121 6.0
Philippines	... ...	... ...	**22** **1.1**	**180** **9.0**	**253** **12.6**	**286** **14.2**	**286** **14.2**	**286** **14.2**	**286** **14.2**	**216** **10.8**	**286** **14.2**	**286** **14.2**	**254** **12.6**	**284** **14.1**
Sri Lanka*					38 1.9	50 2.5	50 2.5	50 2.5	50 2.5	50 2.5	50 2.5	50 2.5	50 2.5	50 2.5
Thailand	... ...	... ...	1 ...	62 3.1	**186** **9.3**	**176** **8.8**	**176** **8.8**	**176** **8.8**	**172** **8.6**	**192** **9.6**	**192** **9.6**	**192** **9.6**	**191** **9.5**	**215** **10.7**
Others	27 1.3	4 0.2	9 0.4	137 6.8	...	...	...	...	...	...	...	...	...	...
Total	**274** **13.6**	**276** **13.7**	**1,375** **68.4**	**5,181** **257.8**	**10,388** **517.2**	**10,987** **546.1**	**10,902** **542.9**	**10,489** **521.4**	**10,395** **517.4**	**10,112** **503.6**	**10,400** **517.9**	**10,274** **511.8**	**10,083** **501.1**	**9,981** **497.0**

*Prior to 1980, included in others

AFRICA

Upper figures = 1,000 b/d
Lower figures = million t/y

	1940	1950	1960	1970	1980	1982	1983	1984	1985	1986	1987	1988	1989	1990
Algeria				47 2.8	122 6.1	122 6.1	137 6.8	137 6.8	464 23.1	465 23.2	465 23.2	465 23.2	465 23.2	465 23.2
Angola-Cabinda	... ...	... ...	2 0.1	20 1.0	36 1.8	32 1.6	32 1.6	32 1.6	32 1.6	32 1.6	32 1.6	32 1.6	32 1.6	32 1.6
Cameroon*						43 2.1	43 2.1	41 2.0	43 2.1	43 2.1	43 2.1	43 2.1	42 2.1	43 2.1
Congo*	... ...	... ...	... ...	... ...	... ...	... ...	... ...	21 1.0	21 1.0	21 1.0	21 1.0	21 1.0	21 1.0	21 1.0
Egypt	17 0.8	39 1.9	87 4.3	193 9.6	234 11.7	292 14.5	341 17.0	369 18.4	369 18.4	434 21.6	452 22.5	452 22.5	489 24.4	489 24.4
Ethiopia*	... ...	... ...	... ...	... ...	14 0.7	14 0.7	14 0.7	15 0.7	14 0.7	18 0.9	18 0.9	18 0.9	18 0.9	18 0.9
Gabon*					20 1.0	20 1.0	20 1.0	20 1.0	20 1.0	23 1.1	16 0.8	23 1.1	24 1.2	24 1.2
Ghana	... ...	... ...	... ...	29 1.4	26 1.3	27 1.3	27 1.3	28 1.4	28 1.4	28 1.4	28 1.4	28 1.4	27 1.3	27 1.3
Ivory Coast				19 0.9	50 2.5	50 2.5	90 4.5	90 4.5	90 4.5	90 4.5	73 3.6	60 3.0	60 3.0	69 3.4
Kenya	... ...	... ...	... ...	44 2.2	95 4.7	79 3.9	79 3.9	79 3.9	95 4.7	95 4.7	95 4.7	90 4.5	90 4.5	95 4.7
Liberia*					15 0.7	15 0.7	15 0.7	15 0.7	15 0.7	15 0.7	15 0.7	15 0.7	15 0.7	15 0.7
Libya	... ...	... ...	... ...	10 0.5	138 6.9	130 6.5	130 6.5	125 6.2	330 16.4	330 16.4	329 16.4	329 16.4	329 16.4	329 16.4
Madagascar*					11 0.5	11 0.5	16 0.8	16 0.8	16 0.8	16 0.8	16 0.8	16 0.8	16 0.8	16 0.8
Morocco	... ...	... ...	2 0.1	35 1.7	72 3.6	72 3.6	74 3.7	74 3.7	80 4.0	81 4.0	81 4.0	155 7.7	155 7.7	155 7.7
Mozambique				20 1.0	16 0.8	16 0.8	16 0.8	17 0.8	17 0.8	17 0.8	17 0.8			
Nigeria	... ...	... ...	... ...	40 2.0	160 8.0	254 12.6	260 12.9	247 12.3	250 12.5	250 12.5	250 12.5	270 13.4	415 20.7	433 21.6
Senegal				13 0.6	20 1.0	18 0.9	18 0.9	18 0.9	30 1.5	30 1.5	30 1.5	30 1.5	30 1.5	24 1.2
Sierra Leone*	... ...	... ...	... ...	... ...	10 0.5	10 0.5	10 0.5	10 0.5	10 0.5	10 0.5	10 0.5	10 0.5	10 0.5	10 0.5
South Africa	1		25 1.2	178 8.9	478 23.8	424 21.1	424 21.1	389 19.4	389 19.4	389 19.4	389 19.4	434 21.6	434 21.6	434 21.6
Sudan	... ...	... ...	... ...	20 1.0	26 1.3	24 1.2	24 1.2	24 1.2	24 1.2	24 1.2	24 1.2	21 1.0	21 1.0	25 1.2
Tanzania				14 0.7	17 0.8	14 0.7	17 0.8	17 0.8	14 0.7	14 0.7	14 0.7	14 0.7	14 0.7	14 0.7
Togo*	... ...	... ...	... ...	... ...	20 1.0	20 1.0	20 1.0	20 1.0	20 1.0	20 1.0	20 1.0	20 1.0	... ...	... ...
Tunisia				23 1.1	34 1.7	34 1.7	34 1.7	34 1.7	34 1.7	34 1.7	34 1.7	34 1.7	34 1.7	34 1.7
Zaire*	... ...	... ...	... ...	... ...	16 0.8	17 0.8	17 0.8	17 0.8	17 0.8	17 0.8	17 0.8	17 0.8	17 0.8	17 0.8
Others				87 4.3	35 1.7	35 1.7	35 1.7	35 1.7	35 1.7	35 1.7	35 1.7	34 1.7	31 1.5	35 1.7
Total	**18** **0.8**	**39** **1.9**	**116** **5.7**	**792** **39.2**	**1,665** **82.9**	**1,773** **88.0**	**1,893** **94.0**	**1,890** **93.8**	**2,457** **122.2**	**2,531** **125.8**	**2,524** **125.5**	**2,631** **130.8**	**2,789** **138.8**	**2,824** **140.4**

*Prior to 1980, included in others

MIDDLE EAST

Upper figures = 1,000 b/d
Lower figures = million t.y.

	1940	1950	1960	1970	1980	1982	1983	1984	1985	1986	1987	1988	1989	1990
Abu Dhabi*					14	128	135	185	185	185	185	180	180	180
					0.7	6.4	6.7	9.2	9.2	9.2	9.2	9.0	9.0	9.0
Bahrain	33	150	187	265	250	250	250	250	250	250	250	250	243	243
	1.6	7.5	9.3	13.2	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.1	12.1
Iran	333	502	495	702	921	530	530	530	530	530	530	530	530	530
	16.6	25.0	24.7	35.0	45.9	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4
Iraq	4	9	56	83	168	169	169	319	319	319	319	319	319	319
	0.2	0.4	2.8	4.1	8.4	8.4	8.4	8.4	15.9	15.9	15.9	15.9	15.9	15.9
Israel		83	87	115	195	190	190	190	170	170	180	180	180	180
		4.1	4.3	5.7	9.7	9.5	9.5	9.5	8.5	8.5	9.0	9.0	9.0	9.0
Jordan*	...	...	...	...	21	91	100	100	100	100	100	100	100	100
	...	...	...	...	1.0	4.5	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Kuwait		25	270	569	645	623	623	623	669	634	618	628	817	819
		1.2	13.4	28.3	32.1	31.0	31.0	31.0	33.3	31.6	30.8	31.3	40.7	40.8
Lebanon	...	6	24	37	53	52	52	52	17	17	37	37	37	37
	...	0.3	1.2	1.8	2.6	2.6	2.6	2.6	0.8	0.8	1.8	1.8	1.8	1.8
Qatar*					11	13	12	63	56	56	62	62	62	62
					0.5	0.6	0.6	3.1	2.8	2.8	3.1	3.1	3.1	3.1
Saudi Arabia†	...	140	189	465	487	487	705	860	840	1,116	1,125	1,375	1,375	1,007
	...	7.0	9.4	23.2	24.3	24.3	35.1	42.8	41.8	55.5	56.0	68.5	68.5	50.1
Syria				54	223	223	229	229	228	229	229	229	244	244
				2.7	11.1	11.1	11.4	11.4	11.4	11.4	11.4	11.4	12.2	12.2
Turkey	...	1	7	209	356	367	467	472	460	460	460	676	725	725
	...	...	0.3	10.4	17.7	18.3	23.3	23.5	22.9	22.9	22.9	33.7	36.1	36.1
Yemen, South			120	178	175	178	178	130	178	162	170	170	162	162
			6.0	8.9	8.7	8.9	8.9	6.5	8.9	8.1	8.5	8.5	8.1	8.1
Others	...	...	1	9	...	...	46	48	50	48	58	87	87	87
	...	...	...	0.4	...	...	2.3	2.4	2.5	2.4	2.9	4.3	4.3	4.3
Total	370	916	1,436	2,686	3,519	3,301	3,686	3,901	4,052	4,275	4,323	4,823	5,061	4,695
	18.4	45.5	71.4	133.7	175.2	164.5	183.7	194.3	201.9	213.0	215.4	240.4	252.2	233.9
Total, excls. U.S.S.R., China, E. Europe	**6,617**	**10,524**	**21,146**	**42,084**	**64,374**	**65,348**	**60,741**	**58,472**	**57,820**	**55,250**	**55,299**	**56,096**	**56,213**	**57,029**
	328.8	**523.5**	**1,052.7**	**2,095.1**	**3,205.6**	**3,254.1**	**3,024.7**	**2,911.7**	**2,879.1**	**2,751.3**	**2,753.8**	**2,793.5**	**2,799.2**	**2,839.6**

*Prior to 1980, included in others. †Includes Neutral Zone.

U.S.S.R.-EASTERN EUROPE-CHINA

Upper figures = 1,000 b/d
Lower figures = million t.y.

	1940	1950	1960	1970	1980	1982	1983	1984	1985	1986	1987	1988	1989	1990
China		8	98	300	1,600	1,810	2,000	2,050	2,150	2,150	2,200	2,200	2,200	2,200
		0.4	4.9	14.9	79.7	90.1	99.6	102.1	107.1	107.1	109.6	109.6	109.6	109.6
Czechoslovakia	...	16	46	220	455	455	455	455	455	455	455	455	455	455
	...	0.8	2.3	11.0	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7
Hungary		20	58	130	290	312	311	312	242	242	242	220	220	220
		1.0	2.9	6.5	14.4	15.5	15.5	15.5	12.1	12.1	12.1	11.0	11.0	11.0
Poland	...	4	20	156	385	385	385	385	385	385	385	385	385	385
	...	0.2	1.0	7.8	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2
Romania		182	260	356	608	617	617	617	617	617	617	617	617	617
		9.1	12.9	17.7	30.3	30.7	30.7	30.7	30.7	30.7	30.7	30.7	30.7	30.7
U.S.S.R.	...	900	2,800	5,640	10,950	11,600	11,750	12,000	12,200	12,260	12,260	12,260	12,300	12,300
	...	44.8	139.4	280.9	545.3	577.7	585.2	597.6	607.6	610.5	610.5	610.5	612.5	612.5
Others		4	40	332	852	852	898	894	894	894	894	852	910	852
		0.2	2.0	16.5	42.4	42.4	44.7	44.5	44.5	44.5	44.5	42.4	45.3	42.4
Total	...	**1,134**	**3,322**	**7,134**	**15,140**	**16,031**	**16,418**	**16,713**	**16,943**	**17,003**	**17,053**	**16,989**	**17,087**	**17,029**
	...	**56.5**	**165.4**	**355.3**	**754.0**	**798.3**	**817.6**	**832.3**	**843.9**	**846.8**	**849.3**	**846.1**	**851.0**	**848.1**
World Total	**6,617**	11,658	24,468	49,218	79,514	81,379	77,157	75,185	74,763	72,253	72,352	73,085	73,300	74,058
	328.8	580.0	1,218.1	2,450.4	3,959.6	4,052.4	3,842.3	3,744.0	3,723.0	3,598.1	3,603.1	3,639.6	3,650.2	3,687.7

Crude oil prices

Year	U.S. refiner acquisition cost: Domestic	Imported	Composite	U.S. landed cost of imports: Total	Canada	Mexico	United Kingdom	Nigeria	Selected countries: Saudi Arabia	Venezuela	Average export prices: World wide	OPEC	Non-OPEC
1976	8.84	13.48	10.89	13.34	13.57	NA	NA	13.80	13.04	11.80	NA	NA	NA
1977	9.55	14.53	11.96	14.31	14.21	13.75	NA	15.25	13.61	13.13	NA	NA	NA
1978	10.61	14.57	12.46	14.38	14.50	13.54	NA	14.86	13.92	12.83	NA	NA	NA
1979	14.27	21.67	17.72	21.65	20.43	20.86	22.16	22.96	19.15	18.18	NA	NA	NA
1980	24.29	33.89	28.07	33.95	30.47	31.80	35.88	37.05	30.02	25.86	NA	NA	NA
1981	34.93	37.05	35.24	36.52	32.16	33.78	37.24	39.70	34.19	29.87	34.81	34.42	36.16
1982	31.22	33.55	31.87	33.18	26.92	26.64	34.28	36.17	35.00	24.82	33.33	33.71	32.3
1983	28.87	29.30	28.99	28.93	25.63	25.78	30.87	30.84	29.76	22.94	29.66	29.89	29.13
1984	28.53	28.88	28.63	28.46	26.59	26.87	29.60	30.50	29.50	25.15	28.60	28.61	28.6
1985	26.66	26.99	25.75	26.66	25.71	25.63	28.35	28.96	24.72	24.43	27.60	28.00	26.98
1986	14.82	14.00	14.55	13.49	13.43	12.17	14.63	15.29	12.84	11.52	14.98	15.45	14.21
1987	17.76	18.13	17.90	17.65	17.04	16.69	18.78	19.32	16.81	15.76	17.41	17.31	17.57
1988	14.74	14.56	14.67	14.08	15.15	12.58	15.82	15.88	13.37	13.66	13.79	13.67	14.04

From: Oil & Gas Journal Energy Database
Source: U.S. Department of Energy

Petroleum product prices

Year	Motor Gasoline (cents/gallon): Regular	Unleaded Regular	Unleaded Premium	Average All Types	Heating Oil (cents/gallon)	Jet Fuel (cents/gallon)	Kerosene (cents/gallon)	No. 2 Diesel Fuel (cents/gallon)	No. 6 Residual Fuel Oil (cents/gallon)	Average Refiner Wholesale Prices: No. 2 Diesel Oil	Propane	Resid
1978	62.60	67.00	NA	65.20	49.00	43.40	53.70	38.60	40.40	36.90	36.50	23.70	26.30
1979	85.70	90.30	NA	88.20	70.40	63.70	72.10	66.00	62.40	56.90	57.40	29.10	39.90
1980	119.10	124.50	NA	122.10	97.40	94.10	112.80	86.80	86.40	80.30	80.10	41.50	52.80
1981	131.10	137.80	147.00	135.30	119.40	106.40	125.00	101.20	106.60	97.60	97.20	46.60	66.30
1982	122.20	129.60	141.50	128.10	116.00	97.30	122.80	95.30	101.80	91.40	91.40	42.70	61.20
1983	115.70	124.10	138.30	122.50	107.80	88.20	117.80	85.40	89.20	81.50	80.80	48.40	60.90
1984	112.90	121.20	136.60	119.80	109.10	83.20	116.50	83.00	91.60	82.10	80.30	45.00	65.40
1985	111.50	120.20	134.00	119.60	105.30	83.50	113.00	79.40	87.40	77.60	77.20	39.80	57.70
1986	85.70	92.70	108.50	93.10	83.60	53.10	91.20	49.50	60.60	48.60	45.20	29.00	30.50
1987	89.70	94.80	109.30	95.70	80.30	58.90	85.90	53.80	59.20	52.70	53.40	25.20	38.50
1988	89.90	94.60	110.70	96.30	81.30	57.70	85.00	49.50	54.90	47.30	47.30	24.00	30.00

From: Oil & Gas Journal Energy Database
Source: U.S. Department of Energy

Comparative energy prices

Year	Natural gas delivered to consumers ($/MCF): Residential	Commercial	Industrial	Electric Utilities	Average	Coal ($/ton)	Crude oil ($/bbl)	Heavy Natural Gas	Light Retail Gasoline	Electricity prices (Cents/Kilowatt Hour): Residential	Commercial	Industrial	Retail Gasoline (Cents/gallon)
1973	1.29	0.94	0.50	0.38	0.68	40.5	78.5	33.8	47.6	2.54	2.41	1.25	1.96
1974	1.46	1.07	0.67	0.51	0.84	70.9	189.0	48.2	91.4	3.10	3.04	1.69	2.49
1975	1.71	1.35	0.96	0.77	1.12	81.4	200.5	75.2	104.4	3.51	3.45	2.07	2.92
1976	1.98	1.64	1.24	0.98	1.37	84.8	195.2	103.4	111.9	3.73	3.69	2.21	3.09
1977	2.35	2.04	1.50	1.32	1.66	94.7	219.8	129.1	129.7	4.05	4.09	2.50	3.42
1978	2.56	2.23	1.70	1.48	1.85	111.6	212.5	142.2	141.1	4.31	4.36	2.79	3.69
1979	2.98	2.73	1.99	1.81	2.21	122.4	298.8	174.9	163.9	4.64	4.68	3.05	3.99
1980	3.68	3.39	2.56	2.27	2.80	135.1	426.7	219.9	192.8	5.36	5.48	3.69	4.73
1981	4.29	4.00	3.14	2.89	3.39	153.2	533.4	280.5	225.6	6.20	6.29	4.29	5.46
1982	5.17	4.82	3.87	3.48	4.15	164.70	483.0	337.6	224.9	6.86	6.86	4.95	6.13
1983	6.06	5.59	4.18	3.58	4.82	165.60	457.0	347.4	220.6	7.18	7.01	4.97	6.29
1984	6.12	5.55	4.22	3.70	4.85	166.40	481.0	360.3	219.1	7.54	7.33	5.04	6.52
1985	6.12	5.50	3.95	3.55	4.72	164.8	424.4	344.4	209.4	7.79	7.47	5.16	6.71
1986	5.83	5.08	3.23	2.43	4.13	157.9	240.1	235.1	175.0	7.41	7.13	4.90	6.42
1987	5.54	4.77	2.94	2.32	4.05	150.6	297.6	224.0	170.6	7.41	7.00	4.72	6.32
1988	5.47	4.63	2.95	2.34	4.09	146.6	240.5	226.3	164.3	7.49	7.01	4.62	6.30

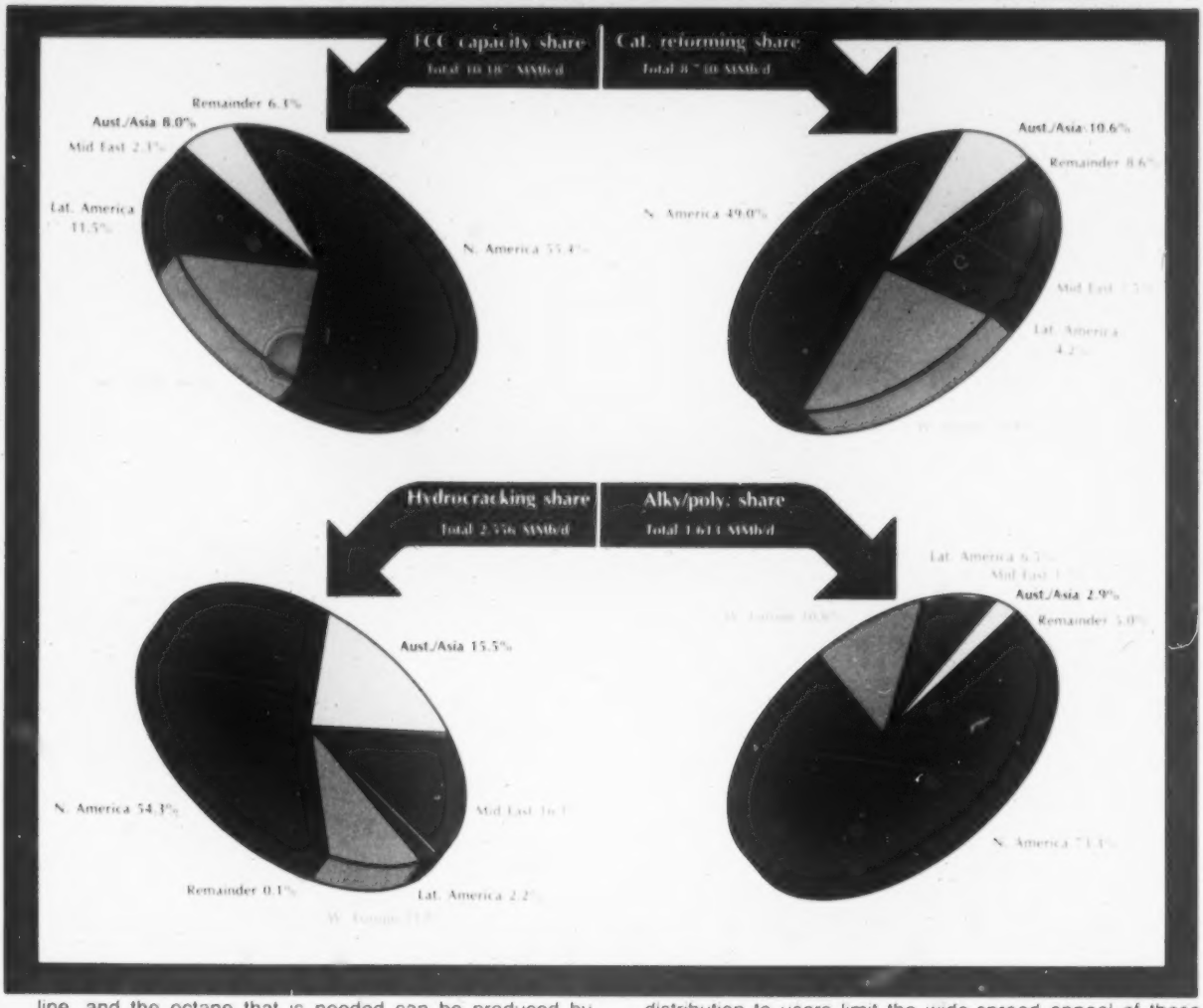
From Oil & Gas Journal Energy Database
Source: U.S. Department of Energy

Price history, crude oil, natural gas and motor gasoline

	Actual current prices						Inflation adjusted real prices				
	Crude oil			Natural gas			Crude oil			Natural Gas	
Year	U.S. average wellhead $/bbl	West Texas Intermediate posted $/bbl	Motor Gasoline leaded pump price $/gal	U.S. average wellhead $/Mcf	Consumer average $/Mcf	Producer Price Index 1982=100	U.S. average wellhead $/BBL	West Texas Intermediate posted $/BBL	Motor Gasoline Leaded pump price $/Gal	U.S. average wellhead $/Mcf	Consumer average $/Mcf
1925	1.68	1.79	0.222	0.094	0.223	17.8	9.438	10.056	1.247	0.528	1.253
1926	1.88	1.90	0.234	0.095	0.229	17.2	10.930	11.047	1.359	0.552	1.311
1927	1.30	1.28	0.211	0.088	0.220	16.5	7.879	7.758	1.278	0.533	1.333
1928	1.17	1.36	0.209	0.089	0.232	16.7	7.006	8.144	1.254	0.533	1.389
1929	1.27	1.45	0.214	0.082	0.216	16.4	7.744	8.841	1.306	0.500	1.317
1930	1.19	0.95	0.200	0.076	0.214	14.9	7.987	6.376	1.339	0.510	1.436
1931	0.65	0.77	0.170	0.070	0.233	12.6	5.159	6.111	1.348	0.556	1.849
1932	0.87	0.69	0.179	0.064	0.247	11.2	7.768	6.161	1.601	0.571	2.205
1933	0.67	1.00	0.178	0.062	0.237	11.4	5.877	8.772	1.563	0.544	2.079
1934	1.00	1.00	0.189	0.060	0.223	12.9	7.752	7.752	1.461	0.465	1.729
1935	0.97	1.00	0.188	0.058	0.224	13.8	7.029	7.246	1.365	0.420	1.623
1936	1.09	1.10	0.195	0.055	0.220	13.9	7.842	7.914	1.399	0.396	1.583
1937	1.18	1.22	0.200	0.051	0.220	14.9	7.919	8.188	1.342	0.342	1.477
1938	1.13	1.02	0.195	0.049	0.218	13.5	8.370	7.556	1.445	0.363	1.615
1939	1.02	1.02	0.188	0.049	0.216	13.3	7.669	7.699	1.410	0.368	1.624
1940	1.02	1.02	0.184	0.045	0.217	13.5	7.556	7.556	1.364	0.333	1.607
1941	1.14	1.17	0.192	0.049	0.221	15.1	7.550	7.748	1.274	0.325	1.464
1942	1.19	1.17	0.204	0.051	0.227	17.0	7.000	6.882	1.202	0.300	1.335
1943	1.20	1.17	0.205	0.052	0.223	17.8	6.742	6.573	1.153	0.292	1.253
1944	1.21	1.17	0.206	0.051	0.215	17.9	6.760	6.536	1.150	0.285	1.201
1945	1.22	1.17	0.205	0.049	0.214	18.2	6.703	6.429	1.126	0.269	1.176
1946	1.41	1.36	0.208	0.053	0.220	20.8	6.779	6.524	0.999	0.255	1.058
1947	1.93	1.84	0.231	0.060	0.232	25.6	7.539	7.188	0.903	0.234	0.906
1948	2.60	2.57	0.259	0.065	0.241	27.7	9.386	9.278	0.934	0.235	0.870
1949	2.54	2.57	0.268	0.063	0.254	26.3	9.658	9.772	1.019	0.240	0.966
1950	2.51	2.57	0.268	0.065	0.266	27.3	9.194	9.414	0.980	0.238	0.974
1951	2.53	2.57	0.272	0.073	0.298	30.4	8.322	8.454	0.893	0.240	0.980
1952	2.53	2.57	0.276	0.078	0.332	29.6	8.547	8.682	0.931	0.264	1.122
1953	2.68	2.72	0.287	0.092	0.355	29.2	9.178	9.298	0.983	0.315	1.216
1954	2.78	2.82	0.290	0.101	0.381	29.3	9.488	9.625	0.991	0.345	1.300
1955	2.77	2.82	0.291	0.104	0.400	29.3	9.454	9.625	0.992	0.355	1.365
1956	2.79	2.82	0.299	0.108	0.415	30.3	9.208	9.307	0.988	0.356	1.370
1957	3.09	3.04	0.310	0.113	0.431	31.2	9.904	9.753	0.992	0.362	1.381
1958	3.01	3.06	0.304	0.119	0.462	31.6	9.525	9.677	0.961	0.377	1.462
1959	2.90	2.98	0.305	0.129	0.477	31.7	9.148	9.385	0.962	0.407	1.505
1960	2.88	2.97	0.311	0.140	0.500	31.7	9.085	9.369	0.982	0.442	1.577
1961	2.89	2.97	0.308	0.151	0.510	31.6	9.146	9.399	0.973	0.478	1.614
1962	2.90	2.97	0.306	0.155	0.514	31.7	9.148	9.369	0.967	0.489	1.621
1963	2.89	2.97	0.304	0.158	0.512	31.6	9.146	9.399	0.963	0.500	1.620
1964	2.88	2.95	0.304	0.154	0.519	31.6	9.114	9.320	0.962	0.487	1.642
1965	2.86	2.92	0.312	0.156	0.522	32.3	8.854	9.040	0.966	0.483	1.616
1966	2.88	2.94	0.321	0.157	0.523	33.3	8.649	8.817	0.964	0.471	1.571
1967	2.92	3.03	0.332	0.160	0.520	33.4	8.743	9.060	0.994	0.479	1.557
1968	2.94	3.07	0.337	0.164	0.504	34.2	8.596	8.977	0.985	0.480	1.474
1969	3.09	3.30	0.348	0.167	0.515	35.6	8.680	9.256	0.978	0.469	1.447
1970	3.18	3.35	0.357	0.171	0.550	36.9	8.618	9.079	0.967	0.463	1.491
1971	3.39	3.56	0.364	0.182	0.590	38.0	8.921	9.368	0.958	0.479	1.553
1972	3.39	3.56	0.361	0.186	0.630	39.8	8.518	8.945	0.907	0.467	1.583
1973	3.89	3.87	0.388	0.216	0.680	45.0	8.644	8.604	0.862	0.480	1.511
1974	6.74	10.37	0.532	0.304	0.840	53.5	12.598	19.383	0.994	0.568	1.570
1975	7.56	11.16	0.567	0.445	1.120	58.4	12.945	19.110	0.971	0.762	1.918
1976	8.14	12.65	0.590	0.580	1.370	61.1	13.322	20.704	0.966	0.949	2.242
1977	8.57	14.30	0.622	0.790	1.660	64.9	13.205	22.034	0.958	1.217	2.558
1978	8.96	14.85	0.626	0.905	1.850	69.9	12.818	21.245	0.896	1.295	2.647
1979	12.51	22.40	0.857	1.178	2.210	78.7	15.896	28.463	1.089	1.497	2.808
1980	21.59	37.37	1.191	1.590	2.800	89.7	24.069	41.661	1.328	1.773	3.122
1981	31.77	36.67	1.311	1.980	3.390	98.0	32.418	37.418	1.338	2.020	3.459
1982	28.52	32.75	1.222	2.460	4.150	100.0	28.520	32.750	1.222	2.460	4.150
1983	26.19	30.25	1.157	2.590	4.820	101.2	25.879	29.891	1.143	2.559	4.763
1984	25.88	29.83	1.129	2.660	4.850	103.6	24.981	28.793	1.090	2.568	4.681
1985	24.09	28.08	1.115	2.510	4.720	103.1	23.366	27.236	1.081	2.435	4.578
1986	12.51	16.44	0.857	1.940	4.130	100.1	12.498	16.421	0.856	1.938	4.046
1987	15.40	18.21	0.897	1.670	4.050	102.8	14.981	17.714	0.873	1.625	3.940
1988	12.58	15.52	0.899	1.690	4.090	106.9	11.768	14.518	0.841	1.581	3.826

From: Oil and Gas Journal Energy Database
Source: U.S. Department of Energy

Downstream refinery process distribution 1



line, and the octane that is needed can be produced by catalytic reforming.

It should also be noted that alkylation works in conjunction with catalytic cracking. The process uses a high percentage of the light gas streams from catalytic cracking units as its feed.

Regulations hit fuel blends

Motor fuels, both gasoline and diesel, are the target of many of the regulations, currently in effect and proposed, to improve air quality in the U.S.

In the U.S., amendments have been proposed to the Clean Air Act. Reduced volatility, reduced aromatics content, and mandated oxygen content of gasoline, and reduced sulfur and aromatics content of diesel are the main thrust of these amendments.

Some of the amendments that will affect U.S. refiners during the 1990s are listed in Table 2.

The push to mandate alternate fuels for transportation use is also growing. These proposed mandates include more use of methanol and compressed natural gas in specific areas of the country. But vehicle fuel system design and fuel distribution to users limit the wide-spread appeal of these fuels.

The U.S. implemented volatility controls on gasoline during 1989. The U.S. Environmental Protection Agency (EPA) took the first step in volatility control by limiting the vapor pressure of gasoline, expressed as Rvp, to 10.5 psi from about 11.5 psi in most of the U.S., and 9 psi in some regions, during the summer of 1989. Subsequent rules will further reduce vapor pressure in 1992.

The thrust of the reduced gasoline vapor pressure is to reduce emissions of volatile organic compounds (VOCs) by about 13% in some parts of the country. These VOCs are contributors to ozone and smog formation.

In most states, the Rvp limit is 10.5 psi from May through September. But tougher limits exist for Arizona and New Mexico where limits are 9.5 psi in May, 9.0 psi in June, July, and August, and 9.5 psi in September.

California, Texas, and Nevada limit Rvp to 9.5 psi from May through September, but have a few exceptions where the limit is only 10.5 psi. The Los Angeles area limits Rvp to 9.0 psi.

In Colorado, Utah, and Oklahoma, the limit is 10.5 psi in May, then 9.5 psi June through September. Other southern

Table 1

World crude capacity breakdown

Region	Crude, MMb/d	% world capy.
N. America	17.272	30.5
W. Europe	12.527	22.1
Aust. Asia	8.681	15.3
Lat. America	6.594	11.6
Mid East	6.179	10.9
Remainder	5.401	9.5
Total	**56.653**	**100**

Table 2

Some air quality issues facing U.S. refiners

	Implementation	Estimated total cost (Billion $)
FEDERAL		
Clean Air Act expansion	1990s	35-50/year
EPA volatility reductions	1992	3/year*
EPA benzene controls	1990s	NA
EPA sanctions on ozone/CO	1988	NA
Alternative Motor Fuels Act	1988	0.0468
SARA Title III	1988	NA
STATE		
California		
State methanol program	1978	0.001
Scaqmd cleans fuels program§	1988-93	0.0304
Scaqmd AQMP	1990s	0.33/year†
Scaqmd NOx rules	1996 deadline	1
CARB diesel sulfur, aromatics rules§	1993	NA
Air toxics hot spots	1988	NA
Seven Northeast states' Rvp cuts	1989	NA
(New York, New Jersey alone)		0.145/year
Western states oxygenated fuels		
Colorado, Arizona, New Mexico	1987	NA

*Does not include estimated loss of $1.1 billion/year in revenues by gas processing plants.
†First phase alone. Second and third phase costs would be much higher.
§Scaqmd: South Coast Air Quality Management District.
AQMP: Air Quality Management Plan.

Table 3

Typical Physical Properties of EC-1

- No lead
- Sulfur 300 ppm (max)
- Rvp 1 psi reduction year round (than southern California criteria)
- Benzene 1%, vol.
- Aromatics 20%
- Bromine no. 20
- 1 wt% oxygen (min)

Source: ARCO Products Co.

Table 4

EC-1 and leaded regular compared

	EC-1	Leaded base
Rvp, psi	7.6	8.9
(R + M)/2 Octane	88.0	86.3
Hydrocarbon types		
FIA, D-1319, Vol %		
Aromatics	19.0	30.1
Olefins	10.0	9.6
Saturates	71.0	60.3
Distillation, D-86		
IBP	88	88
10%	128	123
50%	209	205
90%	351	348
EP	435	432
API gravity	60.4	58.0
Hydrogen, wt %	14.1	13.3
Oxygen, wt %	1.0	0.0
Lead, A.A., g/gal	< 001*	08*
Sulfur, ppm	245	300
Phosphorus, g/gal	0001*	0001*
Bromine No.	21	22
Benzene, Vol. %	0.7	1.6

*SWRI Analyses
Source: ARCO Products Co.

states have the 10.5 psi limit in May, June, and September, and 9.5 psi in July and August.

The volatility reductions limit the amount of normal butane that can be blended into gasoline, and they change the operations of some of the major gasoline producing processes in refineries.

Catalytic reformers are big producers of high-octane gasoline blend component. But reformers produce higher-volatility aromatic compounds when operated to maximum severity (determined by the research octane number of the produced reformate), and therefore, they will have to operate at lower severity.

Refiners will run fluid catalytic crackers to regain the lost octane from lower-severity reformer operation. But all of the lost octane cannot be made up in the FCCU.

Alkylation units will be called upon to help gain back the octane.

For diesel fuels used in highway vehicles (cars, trucks, and intercity busses) the Clean Air Act amendments call for a sulfur content of 0.5 wt% maximum, and sharply reduced aromatics content. The rules are similar to those proposed by EPA in 1986, but a minimum cetane index that will cap aromatics content at current levels will be imposed. The rules are scheduled to go into effect in October 1993.

Alternative fuels

The clean air initiative in the U.S. also calls for wider use of "clean" fuels and vehicles. The initiative applies to nine major metropolitan areas: Los Angeles, Houston, New York, Milwaukee, Baltimore, Philadelphia, Greater Connecticut, San Diego, and Chicago.

The initiative, if enacted, will require 500,000 clean fuel vehicles to be sold in each area in model year 1995, 750,000 in 1996, and 1 million in during 1997-2004.

Within 2 years of enactment of the initiative gasoline sold in non-attainment areas (areas that do not meet ozone, carbon monoxide, particulate, lead, sulfur oxides, and nitrogen oxides emission limits), must be blended during the high carbon monoxide season with enough oxygen to attain the national carbon monoxide ambient standard.

The clean fuels initiative renewed the push for alternative motor fuels in the U.S. Alcohols and compressed natural gas are two popular alternate fuels believed to solve the nation's air-quality problems.

Table 5

European tax incentives encourage unleaded use

Country	Grade	Currency	Tax inc (incl VAT)	Price, premium leaded	Diff. to premium leaded	Financial information: Price price diff. %	Exch. rate used, LC:$	U.S. ¢/l: Tax incent.	U.S. ¢/l: Diff. to premium leaded
		Local currency							
Austria	95	Groschen	−52.0	900.0	−40.0	−4.4	1,257.4	−4.1	−3.2
Austria	91	Groschen	−64.0	900.0	−80.0	−8.9	1,257.4	−5.1	−6.4
Belgium	95	B. Franc	−1.3	−26.4	−1.2	−4.5	37.4	−3.3	−3.2
Denmark	95	Oere	−45.0		−44.0	0.0	692.9	−6.5	−6.4
Denmark	92	Oere	−45.0	0.0	−52.0	0.0	692.9	−6.5	−7.5
Eire	95	Irish Pence	−1.9	58.9	−1.1	−1.9	66.9	−2.8	−1.6
Finland	95	Pennia	−32.6		−20.0	0.0	414.0	−7.9	−4.8
France	95	Franc	0.0	5.1	0.8	15.8	6.1	0.0	13.1
Germany	98	Pfennig	−9.1	120.0	−2.0	−1.7	179.0	−5.1	−1.1
Germany	95	Pfennig	−9.1	120.0	−9.0	−7.5	179.0	−5.1	−5.0
Germany	91	Pfennig	−9.1	120.0	−13.0	−10.8	179.0	−5.1	−7.3
Greece	95	Drachma	−3.8	77.0	6.0	7.8	148.0	−2.5	4.1
Italy	95	Lira	4.0	1,345.0	25.0	1.9	1,312.0	0.3	1.9
Netherlands	95	NL cents	−8.0	157.0	−7.0	−4.5	201.9	−4.0	−3.5
Netherlands	91	NL cents	−4.4	157.0	−8.0	−5.1	201.9	−2.2	−4.0
Norway	95	Oere	−42.3		−38.0	0.0	651.1	−6.5	−5.8
Portugal	95	Escudos	−1.7	119.0	0.0	0.0	146.7	−1.1	0.0
Spain	95	Pesetas	0.5	74.0	5.0	6.8	112.0	0.4	4.5
Sweden	95	Oere	−20.0		−20.0	0.0	611.0	−3.3	−3.3
Switzerland	95	Swiss cents	−9.0		−8.0	0.0	152.2	−4.2	−2.4
U.K.	95	U.K. Pence	−2.3	37.9	−1.3	−3.4	55.0	−4.2	−2.4

Source: Concawe

Table 6

European vehicles will have to meet tighter emission limits

Cubic capacity, C, cc	CO, g/test•	NO_x + HC, g/test•	NO_x, g/test•	Particulates, g/test	Effective date: New models	Effective date: All production
Gasoline vehicle						
C>2,000	25	6.5	3.5		10.1.88	10.1.89
1,400≤C≤2,000	30	8	—		10.1.91	10.1.93
C<1,400	45*	15*	6*		10.1.90	10.1.91
	30†	8†	—		10.1.92	10.1.93¶
	19§	5§	—		7.1.92	12.31.92¶
Diesel vehicle						
C>2,000	30	8	—	1.1	10.1.88	10.1.89
1,400≤C≤2,000	30	8	—	1.1	10.1.91	10.1.93
C<1,400	45*	15*	6*	1.1	10.1.90	10.1.91
	30†	8†*	—	1.1	10.1.91	
	19§	5§	—	1.1	7.1.92	12.31.92

Notes:
*These limits are interim values.
†Limits adopted by the EEC Council in November 1988.
§Latest limits agreed by the EC Council in June 1989.
¶Proposed implementation dates for direct injection engined vehicles are Oct. 1, 1994, for new models and Oct. 1, 1996 for all production. The extension of this derogation to direct injection diesel cars above 2,000 cc is being considered.
•These limits apply to the current ECE 15 urban driving cycle but this is intended to be supplemented by a nonurban (high speed) test. An EEC working group has proposed a test cycle of 400 sec duration incorporating speed up to 120 km/hr but has made no recommendation regarding emission limits for the new test cycle.
EEC Directive 88/436/EEC:
1.1 g/test for type approval;
1.4 g/test for conformity of production.
Implementation dates:
- New models: Oct. 1, 1989
- All production: Oct. 1, 1990
Second stage limits of 0.8 g/test (type approval) and 1.0 g/test (production conformity) are under consideration.
Source: Concawe

Alcohols, both methanol and ethanol, used neat (100%) or in blends with gasoline, have been shown to reduce overall emissions from vehicles. Reduced carbon monoxide and volatile organic compound emissions are the chief features of these so called "clean" fuels.

Compressed natural gas has gained favor as an alternate fuel for specific use vehicles to replace gasoline, and in some cases diesel fuel, such as city busses and vehicles that have well defined, regular routes. Natural gas has a low carbon/hydrogen ratio, thus reducing carbon-based compound emissions, particularly carbon dioxide.

But all of these alternative motor fuels face difficulties with

Table 7

European oxygenate content specifications

	A § vol %	B vol %
Methanol, suitable stabilizing agents must be added*	3	3
Ethanol, stabilizing agents may be necessary*	5	5
Iso-propyl alcohol	5	10
TBA	7	7
Iso-butyl alcohol	7	10
Ethers containing 5 or more carbon atoms per molecule*	10	15
Other organic oxygenates defined in Annex Section 1	7	10
Mixture of any organic oxygenates defined Annex Section 1	2.5% oxygen weight, not exceeding the individual limits fixed above for each component	3.7% oxygen weight, not exceeding the individual limits fixed above for each component

*In accordance with national specifications, or, where these do not exist, industry specifications
†Acetone is authorized up to 0.8% by volume when it is present as by-product of the manufacture of certain organic oxygenate compounds
§Not all countries permit levels exceeding those in Column A, even if the pump is labeled.
Member States were required to take measures to comply with this directive by Jan. 1, 1988.
Source: Concawe

current vehicle fuel system designs, and with distribution of the fuels to the users.

Refiners respond

To counter moves to specify these alternate fuels in place of gasoline, U.S. refiners have begun to design reformulated gasoline and diesel blends that achieve the same environmental benefits of the alternative fuels. The reformulated blends are designed to reduce CO and unburned hydrocarbon emissions from the vehicle tail pipe, and to reduce evaporative emissions during refueling. Reformulated diesel fuels are designed to meet EPA's 1993 diesel fuel standards including sulfur content no more than 0.5 wt%, a minimum cetane rating of 45, and reduced particulate emissions.

The reformulated gasoline blends utilize low-vapor-pressure components, and they use derivatives of the popular alcohols, methyl tertiary butyl ether (MTBE) and ethyl tertiary butyl ether (ETBE). Both of these are low-vapor-pressure compounds that reduce CO emissions.

These new gasoline formulations also make use of modern additives to reduce deposits in engine systems, such as fuel injectors and intake valve ports.

Some of the new reformulated gasolines entered the market in 1989. These reformulated blends are currently designed to replace leaded regular grades in areas of the country that experience severe smog problems.

ARCO introduced a reformulated gasoline in the Los Angeles basin, designed to reduce emissions from older vehicles, those that are not equipped with catalytic converters to control exhaust emissions. The reformulated gasoline replaces the leaded regular grade.

Although these vehicles represent only about 15% of the vehicle population in Southern California, and travel only about 10% of the total vehicle miles, they account for about 30% of the vehicular pollution in the region. The reformulated gasoline will be equivalent to removing about 20% of these vehicles from the road.

The reformulated blend, EC-1, is formulated to decrease the overall level of vehicular emissions including toxic components and reduce the ozone reactivity of the unburned fuel or hydrocarbon portion of these emissions. EC-1 meets all ASTM D4814 requirements, and its typical physical properties are those shown in Table 3. The overall properties of the EC-1 blend are shown in Table 4.

ARCO also announced a reformulated gasoline to meet Arizona's new air quality standards for motor fuel in the Phoenix area. Under Arizona's regulations, gasoline sold in Maricopa County during September 30 to Mar. 15, must have 2.3 wt% oxygen.

ARCO's gasoline will contain 6.5 vol % ethanol, in each of ARCO's three grades.

Several other refining companies have proposed similar reformulated gasolines: Amoco Oil Co., Diamond Shamrock Refining & Marketing Co., and Conoco Inc.

Sun Refining & Marketing Co. introduced a reformulated diesel fuel blend at several of its service stations in the eastern U.S. The fuel will have a maximum sulfur content of 0.5 wt%, a minimum cetane rating of 45, and will be designed for reduced particulate emissions.

Sun is also participating in tests of methanol gasoline blends. The tests are expected to answer emissions, vehicle performance, and fuel transportation and distribution questions concerning the use of M85, an 85% 15% methanol-gasoline blend.

European regs tighten

Emission regulations and fuel quality requirements will tighten as Europe enters the 1990s. The stiffer emission regulations, particularly in those nations in the European Economic Community (EEC), will more closely resemble regulations already in effect in the U.S.

Europe's lead reduction program is underway, but the switch to unleaded gasolines has been slow in the region. Tax incentives and other rules have been introduced to encourage more use of unleaded gasoline (Table 5).

The EEC exhaust emissions Directive 88.76 EEC requires new gasoline vehicles to be designed so that they are capable of operation on 95 research octane unleaded gasoline. All vehicles equipped with catalytic converters must be fitted with filler pipes which cannot accept gasoline dispenser nozzles larger than 23.6 -mm OD.

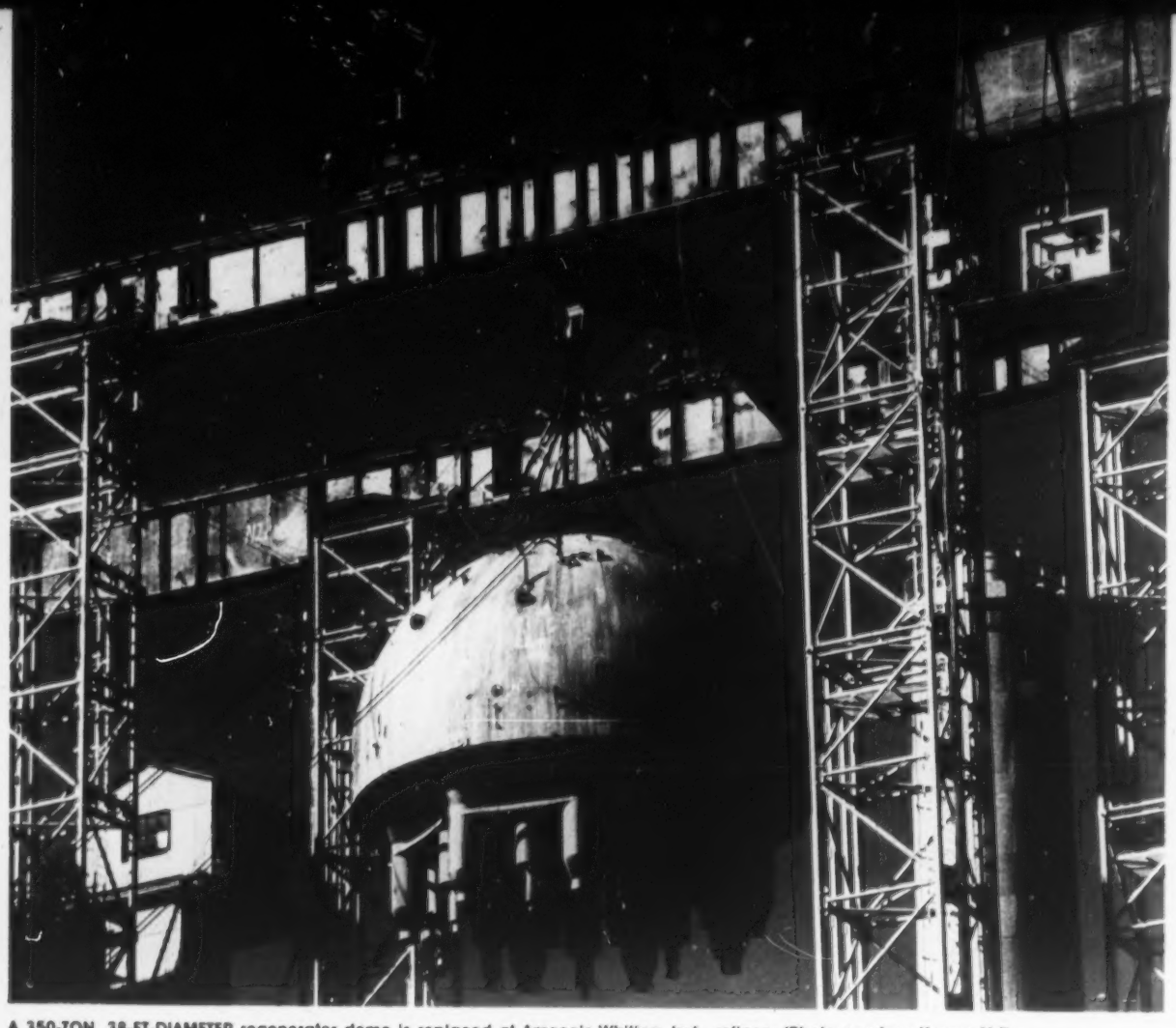
All new models with engines greater than 2 l. displacement had to meet the requirements by Oct. 1, 1988, all other models by Oct. 1, 1989. All production, old and new models, must meet the requirements by Oct. 1, 1990.

European vehicles will also have to meet more stringent emission limits. Reduced carbon monoxide, hydrocarbon and oxides of nitrogen, and particulate emissions are key elements of the new regulations (Table 6).

And as in the U.S., more use of oxygenated compounds will be required in European gasoline blends (Table 7).

The trend in oil consumption toward transportation fuels means that refineries in Europe will have to convert more heavy fuel oil into lighter distillate products. Demand for diesel fuel is increasing in relation to gas oil consumed for heating purposes. At the same time, European refineries will have to rely more on heavier crude oils.

The main effect on diesel fuel quality during the next 10 years will, on average, be somewhat lower cetane index (2 numbers below current levels) and higher density, depending on type of processing and feedstock used. A new diesel fuel with a cetane number of 46 will likely be specified, along with reduced sulfur content. PE



A 350-TON, 38-FT-DIAMETER regenerator dome is replaced at Amoco's Whiting, Ind., refinery (Photo courtesy Kramo Ltd).

Refining survey

YOUR USE OF THE INTERNATIONAL REFINing survey may be aided by the following information.

All country-by-country volumes are presented in calendar-day figures except those for the U.S. In that tabulation, only crude is reported in calendar-day figures. Cat cracking and cat reforming are given in stream-day figures.

In the U.S. tabulation, when an asterisk (*) appears beside a number in the crude column, this indicates that the figure was reported as a stream-day figure and has been converted to a calendar-day figure using the crude conversion factor of 0.95.

Calendar-day figures are the average volume a refinery unit processes each day including downtime used for turnarounds. This is actual total volume for the year divided by 365.

Steam-day figures represent the amount a unit can process when running full capacity for short periods. IPT

LEGEND

CAT CRACKING
1. Fluid
2. Other

CAT REFORMING
Semiregenerative:
1. Conventional catalyst
2. Bimetallic catalyst

Cyclic:
3. Conventional catalyst
4. Bimetallic catalyst

Other:
5. Conventional catalyst
6. Bimetallic catalyst

Cat reforming definitions are:

Semiregenerative. Characterized by shutdown to the reforming unit at specified intervals or at the operator's convenience for regeneration of catalyst in situ.

Cyclic. Characterized by continuous or continual regeneration of catalyst in situ in any one of several reactors that can be isolated from and returned to the reforming operation. This is accomplished without changing feed rate or octane.

Other includes:

Nonregenerative—catalyst replaced by fresh catalyst.

Continuous—continuous regeneration of a part of the catalyst in a special regenerator followed by continuous addition to the reactor.

Moving-bed catalyst systems.

Survey of operating refineries worldwide

(capacities of January 1, 1990)

Country	No. plants	b cd		
		Crude	Catalytic cracking	Catalytic reforming
Abu Dhabi	2	180.000		30.100
Algeria	4	464.700		55.600
Angola	1	32.100		1.900
Argentina	11	688.700	124.700	40.800
Australia	10	675.000	194.700	164.000
Austria	1	204.000	24.000	32.000
Bahrain	1	243.000	39.000	18.000
Bangladesh	1	31.200		1.650
Barbados	1	3.000		
Belgium	4	613.500	104.700	81.400
Bolivia	3	57.500		14.900
Brazil	13	1.397.100	331.100	21.000
Brunei	1	10.000		
Cameroon	1	43.020		6.920
Canada	28	1.851.800	387.470	372.450
Chile	3	146.800	38.870	10.000
Colombia	4	227.400	91.000	6.000
Congo	1	21.000		2.000
Costa Rica	1	16.200		1.200
Cyprus	1	18.000		4.300
Denmark	3	186.500		31.100
Dominican Republic	2	48.500		9.000
Ecuador	5	145.000	16.000	2.800
Egypt	8	489.203		30.940
El Salvador	1	17.000		3.200
Ethiopia	1	18.000		2.270
Finland	2	241.000	41.800	42.900
France	14	1.819.900	325.500	247.400
Gabon	1	24.000		1.400
East Germany	9	795.000	36.000	42.500
West Germany	15	1.507.200	182.700	283.300
Ghana	1	26.600		5.850
Greece	4	384.500	50.500	51.300
Guatemala	1	16.000		3.000
Honduras	1	14.000		1.800
Hungary	3	220.000	20.000	23.000
India	12	1.079.842	136.370	26.230
Indonesia	6	714.200	12.600	61.500
Iran	4	530.000		63.845
Iraq	8	318.500		43.500
Ireland	1	56.000		11.000
Israel	2	180.000	24.000	26.000
Italy	21	2.803.600	305.700	334.850
Ivory Coast	2	69.000		13.600
Jamaica	1	34.200		3.240
Japan	41	4.198.450	617.225	531.800
Jordan	1	100.000	4.250	8.640
Kenya	1	90.000		9.000
Korea	6	867.000		62.450
Kuwait	4	819.000	42.000	33.000
Lebanon	2	37.000	7.250	7.492
Liberia	1	15.000		2.000
Libya	3	329.400		14.182
Madagascar	1	16.350		2.600
Malaysia	4	209.300		24.600
Martinique	1	12.000		3.000
Mexico	9	1.514.000	267.000	157.800
Morocco	2	154.600	5.600	26.800
Myanmar	2	32.000		
Netherlands	7	1.380.700	125.500	178.600
Netherlands Antilles	1	320.000	42.000	15.000
New Zealand	1	96.100		26.600
Nicaragua	1	14.500		2.800
Nigeria	4	433.250	82.700	70.070
Norway	3	295.000	41.000	46.000
Oman	1	76.932		15.386
Pakistan	3	120.275		5.100
Panama	1	100.000		7.500
Paraguay	1	7.500		
Peru	6	172.438	22.540	1.680
Philippines	4	293.800	28.100	39.900
Poland	9	385.454	48.705	31.186
Portugal	3	313.300	10.100	52.200
Puerto Rico	2	123.000	13.500	26.500
Qatar	1	62.000		12.030
Saudi Arabia	7	1.007.000	82.400	167.600
Senegal	1	24.000		2.600
Sierra Leone	1	10.000		
Singapore	5	830.000		61.300
Somalia	1	10.000		
South Africa	4	433.500	64.400	62.800
Spain	10	1.293.000	173.300	172.000
Sri Lanka	1	50.000		3.750
Sudan	1	25.000		2.100
Sweden	5	427.500	25.000	72.000
Switzerland	2	132.000		26.000
Syria	2	243.744		28.380
Taiwan	2	570.000	23.750	59.375
Tanzania	1	13.500		3.000
Thailand	3	214.850	15.700	20.750
Trinidad	2	300.000	28.000	31.000
Tunisia	1	34.000		3.300
Turkey	5	702.560	34.128	62.627
United Kingdom	15	1.253.200	321.500	205.400
Uruguay	1	33.000	4.100	2.500
Virgin Islands	1	545.000		125.000
Yemen, N	1	10.000		2.500
Yemen, S	1	161.500		10.800
Yugoslavia	7	609.135	52.050	74.612
Zaire	1	17.000		3.500
Zambia	1	24.500		5.600
Total	430	41.234.203	4.927.008	4.827.755

Country-by-country refining survey

WORLDWIDE REFINING	b cd Crude capacity	b cd Catalytic cracking	b cd Cat reforming
ABU DHABI			
habi National Oil Co.–Ruwais	120.000		19.200
Umm Al Nar 2	60.000		10.900
Total	**180.000**		**30.100**
ALBANIA			
Government-owned refineries at Ballsh, Cerrik, Stalin			
Total	**40.000**		
ALGERIA			
Sonatrach, Arzew	60.000		8.600
Hassi Messaoud	23.700		2.000
Maison Carree	58.000		15.000
Skikda	323.000		30.000
Total	**464.700**		**55.600**
ANGOLA			
Petrangol, SARL–Luanda	32.100		1.900
ARGENTINA			
Destilería Argentina de Petróleo SA			
Lomas de Zamora	2.000		
Esso SAPA–Campana	93.000	29.600	8.300
Galvan	18.400		
Isaura SA–Bahia Blanca	17.000		
Shell Cia. Argentina de Petroleo SA			
Buenos Aires	121.700	29.200	12.000
Yacimientos Petroliferos Fiscales			
Campo Duran	32.000		
Dock Sud	4.000		
La Plata	216.000	45.000	9.000
Lujan de Cuyo	129.000	20.900	9.000
Plaza Huincul	23.000		2.500
San Lorenzo	37.600		
Total	**688.700**	**124.700**	**40.800**
Solvent Extract., 3.600 b cd			
AUSTRALIA			
Ampol Refineries Ltd., Cymon	72.000	27.500	14.000
Australian Lubricating Oil Refinery Ltd., Kurnell	*		
BP Australia–Brisbane	54.000	17.200	10.500
Kwinana	100.000	24.000	6.300
			16.400
Caltex Refining (Pty), Kurnell	100.000	42.000	24.000
Mobil Oil Australia Ltd., Adelaide			
Petroleum Refineries Australia Pty.			
Adelaide	65.500		20.000
Altona	98.500	24.000	28.000
Shell Refining (Australia) Pty., Clyde	75.000	35.000	13.700
Geelong	110.000	25.000	11.000
			20.000
Total	**675.000**	**194.700**	**164.000**
AUSTRIA			
OeMV, Schwechat	204.000	24.000	14.000
		*6.426	
Total	**204.000**	**24.000**	**32.000**

WORLDWIDE REFINING	b cd Crude capacity	b cd Catalytic cracking	b cd Cat reforming
BAHRAIN			
Bahrain Petroleum Co. BSC (Closed) –Sitra	243.000	39.000	18.000
Total	**243.000**	**39.000**	**18.000**
BANGLADESH			
Eastern Refinery Ltd.–Chittagong	31.200		1.650
BARBADOS			
Mobil Oil Barbados Ltd.–Bridgetown	3.000		
BELGIUM			
Belgian Refining Corp., NV–Antwerp	94.500		12.000
Esso Belgium–Antwerp	239.000	28.200	39.200
Nynas Petroleum NV.–Antwerp	15.000		
Pan Raffinaderij Antwerpen– Antwerp	306.000	76.500	30.200
Total	**513.500**	**104.700**	**81.400**
BOLIVIA			
Yacimientos Petroliferos Fiscales Bolivianos (Cochabamba)	39.500		8.500
Santa Cruz	15.000		6.400
Sucre	3.000		
Total	**57.500**		**14.900**
Solvent extraction, 166 b cd			
BRAZIL			
Petroleo Brasileiro SA, Araucaria			
Parana	144.800	42.300	
Belim, Minas Gerais	144.700	42.700	
Canoas, Rio Grande do Sul	72.400	13.700	
Cubatao, Sao Paulo	179.000	50.900	10.500
Duque de Caxias, Rio de Janeiro	229.000	50.600	10.500
Fortaleza, Ceara			
Manaus, Amazonas	8.500	1.900	
Mataripe, Bahia	126.400	25.000	
Mauá, Santo André, São Paulo	30.200	17.800	
Paulinia, São Paulo	289.900	47.800	
São José dos Campos, São Paulo	156.900	33.900	
Refinaria de Petroleo Ipiranga SA, Rio Grande do Sul	3.800	2.500	
Refinaria de Petroleo de Manguinhos SA, Rio de Janeiro	10.000		
		1.400	
Total	**1.397.100**	**331.100**	**21.000**
Solvent extraction, 27.800 b cd, 30.200 b cd, 34.400 b cd			
BRUNEI			
Brunei Shell Petroleum Co.–Seria	10.000		
BULGARIA			
Government owned refineries at Burgas, Pleven, Ruse			
Total	**300.000**		
CAMEROON			
Somara National Refining Co. Cape Limboh–Limbe	43.020		6.920

WORLDWIDE REFINING	Crude capacity (b cd)	Catalytic cracking (b cd)	Cat reforming (b cd)
CANADA			
Alberta			
Husky Oil Operations Ltd.–Lloydminster	25 000		
Imperial Oil Ltd.–Edmonton	164 900	47 000	20 900
Parkland Refining Ltd.–Bowden	6 000		3 000
Petro-Canada Products Inc.–Edmonton	115 500	33 300	12 600
Shell Canada Ltd.–Scotford	59 800		21 500
Turbo Resources Ltd.–Bazac	27 500	11 570	7 550
Total	398 700	91 870	65 550
British Columbia			
Chevron Canada Ltd.–North Burnaby	36 000	10 500	10 000
Husky Oil Operations Ltd.–Prince George	9 600	2 900	1 250
Imperial Oil Ltd.–Ioco	42 800	12 300	6 700
Petro-Canada Products Inc.–Port Moody	25 500		8 600
Taylor	17 400	6 300	3 000
Shell Canada Ltd.–Shellburn, Burnaby	24 000	5 600	3 600
Total	155 300	37 600	33 150
New Brunswick			
Irving Oil Ltd.–St. John	237 500	17 100	34 650
Total	237 500	17 100	34 650
Newfoundland			
Newfoundland Processing Ltd.–Come By Chance	105 000		25 000
Total	105 000		26 000
Northwest Territories			
Imperial Oil Ltd.–Norman Wells	3 500		
Nova Scotia			
Imperial Oil Ltd.–Dartmouth	82 300	23 000	8 600
McCall Frontenac Inc.–Halifax	20 000	7 200	3 600
Total	102 300	30 200	12 200
Ontario			
Imperial Oil Ltd.–Sarnia	122 600	24 500	13 300
			14 300
Petro-Canada Products Inc.–Clarkson	41 500		9 800
Oakville	80 500	25 400	5 000
Shell Canada Ltd.–Sarnia	77 000	14 400	27 000
Suncor Inc.–Sarnia	70 000	16 000	26 000
McCall Frontenac Inc.–Nanticoke	95 000	40 000	24 000
Total	480 600	119 300	124 900
Quebec			
Petro-Canada Products Inc.–Montreal	87 400	17 200	31 800
Shell Canada Ltd.–Montreal	120 000	22 000	20 700
Ultramar Canada Inc.–St. Romuald	103 000	34 600	15 000
Total	310 400	73 800	67 000
Saskatchewan			
Consumers' Cooperative Refineries Ltd.–Regina	45 200	17 600	9 000
Producers Pipeline–Moose Jaw	13 300		
Total	58 500	17 600	9 000
Total Canada	1 851 800	387 470	372 450
CHILE			
ENAP–Gregorio Magallanes	8 800		
Petrox SA–Talcahuano	72 000	18 870	4 000
Refineria de Concon–Concon	66 000	20 000	6 000
Total	146 800	38 870	10 000

WORLDWIDE REFINING	Crude capacity (b cd)	Catalytic cracking (b cd)	Cat reforming (b cd)
CHINA			
Government-owned refineries at Anshan, Beijing, Dalian, Daqing, Fushun, Hangzhou, Jinxi, Karamai-Dushanzi, Lanchow, Lenghu, Maming, Nanchong, Nanjing, Shanghai, Shengli, Tianjin, Yumen			
Total	2 200 000		
COLOMBIA			
Empresa Colombiana de Petroleos–Barrancabermeja, Santander	150 000	62 000	6 000
Cartagena, Bolivar	70 000	29 000	
Orito, Putumayo	2 400		
Tibu, N. de Santander	5 000		
Total	227 400	91 000	6 000
Solvent extraction – 35 000 b cd			
CONGO			
Coral–Pointe-Noire	21 000		2 000
COSTA RICA			
Refinadora Costarricense de Petroleo SA–Limon	16 200		1 200
Total	16 200		1 200
CUBA			
Government-owned refineries at Cabaiguan, Cienfuegos, Havana, Santiago de Cuba			
Total	280 000		
CYPRUS			
Cyprus Petroleum Refinery Ltd.–Larnaca	18 000		4 300
CZECHOSLOVAKIA			
Government-owned refineries at Bratislava, Kolin, Kralupy, Pardubice, Slusovice, Zaluzi, Zvolen			
Total	455 000		
DENMARK			
AS Dansk Shell Fredericia	65 000	12 000	
Statoil AS–Kalundborg	69 000		8 600
KuwAit Petroleum Refining (Danmark) A S–Gulfhavn	56 500		10 500
Total	186 500		31 100
DOMINICAN REPUBLIC			
Falconbridge Dominicana C por A–La Boiao	16 000		
Refineria Dominicana de Petroleo SA–Haina	32 500		9 000
Total	48 500		9 000
ECUADOR			
CEPE–Esmeraldas	90 000	16 000	2 800
Sta. Elena Peninsula	36 000		
Referia Amazonas	10 000		
Repetrol–Santa Elena	8 000		
Texaco–Lago Agrio	1 000		
Total	145 000	16 000	2 800
EGYPT			
Alexandria Petroleum Co.–Alexandria (El Mex)	99 700		
Cairo Oil Refining Co.–Mostorod	125 000		9 000
Tanta	21 800		
El Amreia Oil Refining Co.–Alexandria	50 140		9 400
El Nasr Petroleum Co.–El Suez	58 400		
Wadi Feran	9 680		

WORLDWIDE REFINING	Crude capacity	b cd Catalytic cracking	Cat reforming
Suez Oil Processing Co.–El Suez	62.530		12.540
Assiout	52.143		
Total	**489.203**		**30.940**
EI SALVADOR			
Refinéria Petroleira Acajutla SA–Acajutla	17.000		3.200
Total	**17.000**		**3.200**
ETHIOPIA			
Ethiopian Petroleum Corp.–Assab	18.000		2.270
FINLAND			
Neste Oy–Naantali	44.000	13.300	6.800
Porvoo	197.000	28.500	36.100
Total	**241.000**	**41.800**	**42.900**
FRANCE			
CRD—Total France–			
Gonfreville L'Orcher	309.000	31.500	45.400
La Mède	136.000	29.700	23.400
Mardyck	122.000	29.800	20.500
Cie. Rhenane de Raffinage–			
Reichstett-Vendenheim	80.000	14.000	13.000
Et. France–Donges	200.000	66.000	25.600
Feyzin	120.000	22.700	8.600
Grandpuits	92.000	28.800	12.900
Esso SAF–Fos sur Mer	100.000	22.000	16.000
Port Jerome	136.000	24.000	16.000
Mobil Oil Francaise–			
Notre Dame de Gravenchon	57.000		13.300
Shell Francaise–Berre l'Etang	128.000	38.000	19.000
Petit Couronne	158.000	20.000	28.000
Ste. Francaise des Petroles BP–			
Dunkerk			
Lavera	181.900	26.000	5.700
Total	**1.819.900**	**325.500**	**247.400**

[1] Solvent extraction: 9.600 b cd.

WORLDWIDE REFINING	Crude capacity	b cd Catalytic cracking	Cat reforming
GABON			
Ste. Gabonaise de Raffinage–Port Gentil	24.000		1.400
GERMANY, EAST			
Government-owned	470.000		
Veb Petrolchemisches Kombinat			
4 Refineries	325.000	36.000	26.000
		[1] 6.500	
Total	**795.000**	**36.000**	**42.500**
GERMANY, WEST			
BP Oiltech Gmbh			
DEA Mineralöel AG–Heide	80.000	9.000	[2] 20.000
UK-Wesseling	90.000		[2] 19.000
Deutsche BP Erdol Ingolstadt–			
Vohburg†	102.000	17.200	17.200
DMP Mineralöl Petrochemie			
GmbH–Burghausen	72.000		
Deutsche Shell AG–Godorf	170.000		12.000
		7.000	
Harburg-Grasbrook	86.000	15.000	[2] 16.000
Erdoel Raffinerie Neustadt			
GmbH–Neustadt-Donau	144.000	26.000	12.700
Esso AG–Ingolstadt	95.000	24.500	12.800
Karlsruhe	150.000		27.900
Mobil Oil AG–Wörth	93.000	18.000	15.900
Oberrheinische Mineralölwerke			
GmbH–Karlsruhe	142.000	66.000	11.400
Ruhr Oel GmbH–Gelsenkirchen	215.400	6.000	11.900
			27.000

WORLDWIDE REFINING	Crude capacity	b cd Catalytic cracking	Cat reforming
Wintershall AG–Lingen	65.000		[2] 2.200
			[2] 5.000
Salzbergen	2.800		
Total	**1.507.200**	**182.700**	**283.300**

† Operating on a semi-integrated basis.

[2] Operating on a semi-integrated basis.

WORLDWIDE REFINING	Crude capacity	b cd Catalytic cracking	Cat reforming
GHANA			
Ghanaian Italian Petroleum Cl.–Tema	26.600		5.850
GREECE			
Hellenic Aspropyrgos Refinery SA–			
Aspropyrgos	110.000	23.300	9.500
			20.000
Motor Oil (Hellas) Corinth Refineries SA–Aghii Theodori	100.000	27.200	8.500
Petrola Hellas SA–Elefsis	108.000		
Thessaloniki Refining Co. AE–			
Thessaloniki	66.500		8.100
Total	**384.500**	**50.500**	**51.300**
GUATEMALA			
Texas Petroleum Co.–Escuintla	16.000		3.000
Total	**16.000**		**3.000**
HONDURAS			
Refineria Texas de Honduras SA–Puerto Cortes	14.000		1.800
Total	**14.000**		**1.800**
HUNGARY			
Duna: KV-Szazhalombatta	150.000	20.000	23.000
Tisza: KV-Lennvaros	60.000		
Zala: KV-Zalaegerszeg	10.000		
Total	**220.000**	**20.000**	**23.000**
INDIA			
Bharat Petroleum Cl.–Mahul–Bombay	156.600	33.600	5.400
Bongaigaon Refinery & Petrochemicals Ltd.–Bongaigaon–Assam	27.392		1.930
Cochin Refineries Ltd.–Ambalamugal	80.000	20.000	5.000
Hindustan Petroleum Cl.–			
Mahul–Bombay	111.650	12.000	
Visakhapatnam	90.050	19.200	
Indian Oil Cl.–Barauni	66.000		
Digboi	10.050		
Guwahati	15.400		
Gujarat	142.050	19.800	7.000
Haldia	55.000		4.500
Mathura	150.000	19.800	
Madras Refineries Ltd.–Madras	114.700	11.770	2.400
Total	**1.079.842**	**136.370**	**26.230**

[1] Solvent extraction: 10.000 b cd.

WORLDWIDE REFINING	Crude capacity	b cd Catalytic cracking	Cat reforming
INDONESIA			
Pertamina–Balikpapan–Kalimantan	221.500		18.000
Cilacap–Central Java	271.200		12.000
			18.000
Dumai–Central Sumatra	7.400		5.600
			17.900
Musi–South Sumatra	81.400	12.600	
Pangkalan Brandan–North Sumatra	4.500		
Sungai Pakning–Central Sumatra	96.200		
Total	**714.200**	**12.600**	**61.500**
IRAN			
National Iranian Oil Co.–Esfahan	200.000		29.600
Shiraz	40.000		6.245

WORLDWIDE REFINING	Crude capacity	b cd Catalytic cracking	Cat reforming
Tabriz	80.000		
Tehran	210.000		28.000
Total	**530.000**	....	**63.845**

Note: Present status uncertain due to Iran-Iraq war

IRAQ

Oil Refineries Administration-Baiji	150.000		22.000
			16.500
Basra	70.000		
Daura	71.000		5.000
Kirkuk	7.000		
Khanaqin	12.000		
Muthna	4.500		
Qayarah, Mosul	2.000		
Iraqi Company for Oil Operations-Kirkuk	2.000		
Total	**318.500**	....	**43.500**

Note: Present status uncertain due to Iran-Iraq war

IRELAND

Irish Refining plc-Whitegate	**56.000**		**[1]11.000**

ISRAEL

Oil Refineries Ltd.-Ashdod	70.000		[1]11.000
Haifa	110.000	24.000	15.000
Total	**180.000**	**24.000**	**26.000**

ITALY

Agip Plus SpA-Livorno	100.000		[1]8.500
			[2]9.000
Agip Raffinazione SpA-Porto Marghera	90.000		11.000
Rho, Milan	79.800	14.300	17.000
Sannazzaro, Pavia	210.000	27.000	10.000
Taranto	83.300		17.000
		[3]7.250	
Venezia	90.000		16.000
Anonima Petroli Italiana-Falconara Marittima	78.900		10.500
Arcola Petrolifera SpA-La Spezia	[4]8.000		
Esso Italiana SpA-Augusta, Siracusa	180.000	45.300	22.300
Industrie Chimiche Italiane de Petrolio SpA-Frassino, Mantova	55.000		7.000
Ipiom SpA-Busalla	46.500		
Isab-Priolo Gargallo	220.000		[1]34.500
Mobil Oil Italiana SpA-Naples	100.000	25.500	12.500
Raffineria di Roma SpA-Rome	81.500		14.200
Raffineria Mediterranea Spa-Milazzo	160.000	28.000	11.000
Raffineria Siciliana SrL-Gela	105.000	35.000	13.850
Saras SpA-Sarroch	285.000	63.000	27.000
Sarpom-S. Martino Di Trecate	244.100	17.600	18.500
			[1]8.100
Novara	241.500	18.000	18.900
			[1]8.900
Selm-Soc. Energia Montedison-Priolo	240.000	32.000	[1]9.000
Tamoil Italia SpA-Cremona	[1]95.000		12.400
Total	**2.803.600**	**305.700**	**334.850**

IVORY COAST

Ste. Ivorienne de Raffinage-Abidjan	59.000		[1]13.600
Ste. Multinationale de Bitumes-Abidjan	10.000		
Total	**69.000**	....	**13.600**

JAMAICA

Petrojam Ltd.-Kingston	34.200		[1]3.240
Total	**34.200**	....	**3.240**

JAPAN

Cosmo Oil CL-Chiba			
Sakai	133.000	[1]16.150	[1]9.500
Sakay	104.500	[1]18.525	[1]6.650
Yokkaichi City	166.250	[1]23.750	[1]5.700
			[1]10.450
Fuji Oil CL-Sodegaura,Chiba	126.600	[1]14.000	[1]6.300
General Sekiyu Seisei KK-Sakai	140.400	[1]32.500	[1]26.100
Idemitsu Kosan CL-Chita, Aichi	123.500	[1]27.000	[1]16.200
Himeji, Hyogo	104.500		[1]12.600
Ichihara, Chiba	199.500	[1]37.800	[1]15.300
Tokuyama, Yamaguchi	95.000	[1]20.700	
Tomakomai, Hokkaido	85.500	[1]16.200	
Kainan Petroleum Refining CL-Kaiwan City, Wakayama	64.000		
Kashima Oil CL-Kashima, Ibaragi	150.000	[1]17.500	[1]7.500
Koa Oil CL-Marifu	110.000	[1]20.000	[1]9.700
Osaka	80.000	[1]18.000	[1]9.000
Kyokuto Petroleum Ltd.-Chiba	120.000		[1]19.000
Kyushu Oil CL-Oita	130.000	[1]16.500	[1]8.000
Mitsubishi Oil CL-Kawasaki	55.000		[1]10.000
Mizushima	220.000	[1]34.000	[1]25.000
			[1]18.500
Nansei Sekiyu KK-Nishihara, Okinawa	50.000		[1]9.600
Nichimo Sekiyu Seisei KK-Kawasaki	76.000		[1]7.600
Nihonkai Oil CL-Toyama	46.000	[1]5.000	
Nippon Mining CL-Chita	85.000	[1]13.000	[1]22.000
Funakawa	6.000		
Mizushima	190.200	[1]38.000	[1]20.000
Nippon Oil CL-Niigata	26.000	[1]4.000	
Nippon Petroleum Refining CL-Muroran	150.000	[1]21.000	[1]21.000
Nakagusuku, Okinawa			[1]2.500
Negishi	305.000	[1]39.000	[1]20.000
Yokohama			[1]1.300
Okinawa Sekiyu Seisei-Yonashiro, Okinawa	57.000		
Seibu Oil CL-Yamaguchi	110.100	[1]19.900	[1]20.000
Showa Shell Sekiyu KK-Kawasaki	95.000		[1]14.000
Niigata	27.100		[1]4.300
Showa Yokkaichi Sekiyu CL-Yokkaichi	180.000	[1]25.000	[1]45.600
Taiyo Oil CL-Ehime	61.700		[1]5.400
Toa Nenryo Kogyo-Kawasaki	190.000	[1]76.100	[1]15.200
Wakayama	157.700	[1]33.600	[1]34.200
Toa Oil CL-Kawasaki	65.000	[1]30.000	[1]8.000
Toho Oil CL-Owase	35.000		
Tohoku Oil CL-Sendai	77.900		[1]11.600
Total	**4.198.450**	**617.225**	**531.800**

JORDAN

Jordan Petroleum Refinery-Zerka	100.000	[1]4.250	[1]8.640
Total	**100.000**	**4.250**	**8.640**

KENYA

Kenya Petroleum Refineries Ltd.-Mombasa	90.000		[1]3.800
			[2]5.200
Total	**90.000**	....	**9.000**

KOREA, N.

Government-owned, Unggi	**42.000**		

KOREA, S.

Honam Oil Refinery CL-Yocheon	342.000		[1]15.300
Kukdong Oil CL-Busan	10.000		
Seosan	60.000		[1]3.000
Kyung In Energy CL-Inchon	60.000		[1]3.600
Ssangyong Oil Refining CL-Onsan	90.000		[1]4.000
Yukong Ltd.-Ulsan	305.000		[1]17.650
			[1]18.900
Total	**867.000**	....	**62.450**

Solvent extraction: [1]2.100 b d; [2]8.000 b d

KUWAIT

Getty Oil Co. (subsidiary of Texaco Inc.)-Mina Al-Zour	72.000		
Kuwait National Petroleum Co.-Mina Abdulla	190.000		
Mina Al-Ahmadi	370.000	[1]28.000	[1]33.000
Shuaiba	187.000	[1]14.000	
Total	**819.000**	**42.000**	**33.000**

WORLDWIDE REFINING	b cd Crude capacity	b cd Catalytic cracking	b cd Cat reforming
LEBANON			
Tripoli Oil Installations–Tripoli	20.000	†7.250	†4.392
Mediterranean Refining Co –Sidon	17.000		†3.100
Total	**37.000**	**7.250**	**7.492**
LIBERIA			
Liberia Petroleum Refining–Monrovia	15.000		†2.000
Total	**15.000**	....	**2.000**
LIBYA			
Azzawiya Oil Refining Co –Azzawiya	120.000		†2.982
Ras Lanuf Oil & Gas Processing Co –Ras Lanuf	201.000		
Sirte Oil Co –Brega	8.400		†1.200
Total	**329.400**	....	**14.182**
MADAGASCAR			
Solima–Managareza, Tamatave	**16.350**	....	**2.600**
MALAYSIA			
Esso Malaysia Berhad–Port Dickson	47.300		†7.600
Petronas Penapisan Sdn. Berhad–Kerteh, Kemaman, Terengganu	27.000		
Sarawak Shell Berhad–Luton	45.000		
Shell Refining Co. Berhad–Port Dickson	90.000		†4.000 ‡13.000
Total	**209.300**	....	**24.600**
MARTINIQUE			
Ste. Anonyme de la Raffinerie des Antilles–Fort-de-France	12.000		†3.000
Total	**12.000**	....	**3.000**
MEXICO			
Petroleos Mexicanos–Azcapotzalco	105.000	†24.000	
Cadereyta	235.000	†40.000	†20.000
Ciudad Madero	195.000	†43.000	†15.000
		‡9.000	
Minatitlan	200.000	†24.000	†48.000
		†16.000	
Poza Rica	50.000		
Reynosa	9.000		
Salamanca	235.000	†40.000	†24.800
Salina Cruz	165.000	†40.000	†20.000
Tula, Hidalgo	320.000	†40.000	†30.000
Total	**1,514.000**	**267.000**	**157.800**

†Solvent extraction. ‡8.000 b cd.

WORLDWIDE REFINING	b cd Crude capacity	b cd Catalytic cracking	b cd Cat reforming
MOROCCO			
Samir–Mohammedia	129.000		†24.000
Ste. Cherifienne des Petroles, Sidi Kacem	25.600	†5.600	†2.800
Total	**154.600**	**5.600**	**26.800**
MYANMAR			
Myanma Petrochemical Enterprise–Chauk	6.000		
Thanlyin	26.000		
Total	**32.000**	....	....

Formerly Burma.

NETHERLANDS			
BP Raffinaderij Nederland NV–Rotterdam	437.000	†47.500	†27.000
Esso Nederland BV–Rotterdam	153.200		‡26.600
Kuwait Petroleum Europoort BV–Rotterdam	75.500		‡19.000
Shell Nederland Raffinaderij BV–Pernis	348.000	†78.000	†17.000 ‡42.000
Smid & Hollander Raffinaderij BV–Amsterdam	10.000		
Texaco Petroleum Mij. (Nederland) BV–Pernis	207.000		†29.000
Total Raffinaderij Nederland NV–Vlissingen	150.000		†18.000
Total	**1,380.700**	**125.500**	**178.600**

†Solvent extraction. ‡3.200 b cd.

NETHERLANDS ANTILLES			
Refineria Isla Curazao SA–Emmastad	320.000	†42.000	†15.000
Total	**320.000**	**42.000**	**15.000**
NEW ZEALAND			
New Zealand Refining–Whangarei	95.100		†26.600
Total	**95.100**	....	**26.600**

†Solvent extraction. ‡6.100 b cd.

NICARAGUA			
Esso Standard Oil SA Ltd –Managua	14.500		†2.800
Total	**14.500**	....	**2.800**
NIGERIA			
Kaduna Refinery & Petrochemical Co. (NNPC)–Kaduna	†04.500	†18.000	†5.300
Port Harcourt Refining Co. (NNPC)–Alesa Eleme	60.000		†6.000
Rivers State	150.000	†40.000	‡33.000
Warri Refinery & Petrochemical Co. (NNPC)–Warri	118.750	†24.700	†5.770
Total	**433.250**	**82.700**	**70.070**

†Solvent extraction. ‡9.492 b cd.
‡Dimersol.

NORWAY			
Esso Norge AS–Slagen-Valloy	90.000		†10.000
Norske Shell AS–Sola	60.000		†10.000
Rafinor AS–Mongstad	145.000	41.000	†10.000 †16.000
Total	**295.000**	**41.000**	**46.000**
OMAN			
Oman Refinery Co –Mina Al Fahal	76.932	....	15.386
PAKISTAN			
Attock Refinery Ltd –Rawalpindi	30.500		
National Refinery Ltd –Korangi, Karachi	44.175		†2.100
Pakistan Refinery Ltd., Karachi	46.250		†3.000
Total	**120.925**	....	**5.100**

†Solvent Extraction. 5.605.

PANAMA			
Refineria Panama SA–Las Minas	100.000		†7.500
Total	**100.000**	....	**7.500**
PARAGUAY			
Petroleos Paraguayos–Villa Elisa	**7.500**	....	....
PERU			
Petroleos del Peru			
Conchan	5.670		
Iquitos, Loreto	9.450		
La Pampilla, Lima	93.900	†7.600	‡1.680
Marsella, Loreto	1.953		
Pucallpa	2.565		

WORLDWIDE REFINING	b cd Crude capacity	b cd Catalytic cracking	b cd Cat reforming
Talara	58.900	[1]4.940	
Total	**172.438**	**22.540**	**1.680**
PHILIPPINES			
Caltex (Philippines) Inc.–Batangas	63.000	[2]8.100	[2]8.100
Petron Corp.–Limay, Bataan	155.000	[3]15.000	[2]6.800
			[2]17.000
Philippine Petroleum Corp.–Pililla			
Pilipinas Shell Petroleum–Tabangao	65.800		[2]8.000
Total	**283.800**	**23.100**	**39.900**
[1] Polymerization. Mothballed.			
POLAND			
Government-owned refineries at Czechowice, Gdansk, Glinik, Mariampolski, Jasto, Jedlicze, Krakaty, L. Warynski, Trzebinia. Crude capacity 133.000 b cd			
Mazovian Refinery & Petrochemical Works, Plock	252.454	48.705	31.186
Total	**385.454**	**48.705**	**31.186**
PORTUGAL			
Petrogal–Lisbon		[1]10.100	
Leça da Palmeira, Porto	88.300		[2]14.200
Sines	225.000		[2]27.500
Total	**313.300**	**10.100**	**52.200**
PUERTO RICO			
Caribbean Petroleum Corp.–Bayamon	38.000	[1]3.500	[2]6.500
Puerto Rico Sun Oil Co.–Yabucoa	85.000		[2]20.000
Total	**123.000**	**13.500**	**26.500**
Solvent extraction: 16.000 b cd.			
QATAR			
National Oil Distribution Co.–			
Umm Said	62.000		[2]2.200
			[2]9.830
Total	**62.000**	....	**12.030**
ROMANIA			
Government-owned refineries at Bacau, Borzesti, Brazi, Brazov, Campina, Darmanesti, G. Gheorghiu Dej, Navodari, Onesti, Pitesti, Ploesti, Sulpacu, and Teleajen			
Total	**617.000**		
SAUDI ARABIA			
Saudi Arabian Oil Co. (Saudi Aramco)–			
Ras Tanura	53.000		[2]50.000
Arabian Oil Co.–Ras Al Khafji	30.000		
Jeddah Oil Refinery–Jeddah	95.000	[1]11.000	[2]3.000
Petromin-Mobil–Yanbu	250.000	[2]66.000	[2]32.000
Petromin-Shell–Al Jubail	275.060		[2]19.000
Riyadh Oil Refinery–Riyadh	134.000		[2]28.600
			[2]5.400
Yanbu Petromin Refinery–Yanbu	170.000		[2]35.000
Total	**1.007.000**	**82.400**	**167.600**
Solvent extraction: [1]12.500 b cd; [2]8.800 b cd.			
SENEGAL			
Ste. Africaine de Raffinage–M'Bao (Dakar)	**24.000**	....	**2.600**
SIERRA LEONE			
Sierra Leone Petroleum Refining Co.–Freetown	**10.000**	....	....
SINGAPORE			
BP Refinery Singapore PL–Pasir Panjang	30.000		
Esso Singapore PL–Pulau Ayer Chawan	170.000		11.600
Mobil Oil Singapore PL–Jurong	193.000		18.000
Shell Eastern Petroleum Ltd.–			
Pulau Bukom	258.000		[2]6.800
			[2]13.900
Singapore Petroleum CPL[†]–			
Pulau Merlimau	179.000		[2]11.000
Total	**830.000**	....	**61.300**
[†] Singapore Petroleum CPL shares percentages of refinery capacities.			
SOMALIA			
Iraqsoma Ref. Co.–Mogadishu	**10.000**	....	....
SOUTH AFRICA			
Caltex Oil SA PL–Cape Town	90.000	[1]25.000	[1]10.500
Gencor–			
Durban	65.000	[1]15.000	[1]15.000
National Petroleum Refiners of South Africa PL–Sasolburg OFS	78.500	17.400	[1]11.300
Shell and BP South Africa Petroleum Refineries PL–Durban	200.000	[1]27.000	26.000
Total	**433.500**	**84.400**	**62.800**
SPAIN			
Asfaltos Espanoles SA–Tarragona	21.000		
Cia. Espanola de Petroles–San Roque (Cadiz)	[1]60.000	[1]35.000	35.000
Tenerife	[1]30.000		[1]4.000
Petroleos del Mediterraneo–			
Castellon de la Plana	120.000	23.300	[1]13.400
Petronor SA–Somorrostro, Vizcaya	220.000	40.000	30.500
Repsol Petroleo SA–Cartagena, Murcia	112.000		25.000
La Coruna	135.000	28.000	22.000
Puertollano, Ciudad Real	135.000	30.000	18.000
Tarragona	180.000	[1]6.000	
Union Explosivos Rio Tinto SA–			
La Rabida, Huelva	80.000		[1]4.100
Total	**1.293.000**	**173.300**	**172.000**
SRI LANKA			
Ceylon Petroleum Corp.–			
Sapugaskanda	50.000		3.750
Total	**50.000**	....	**3.750**
SUDAN			
Port Sudan Refinery Ltd., Port Sudan	**25.000**	....	**2.100**
SWEDEN			
AB Nynas Petroleum–Gothenburg	12.500		
Nynashamn	28.000		
BP Raffinaderi–Gothenburg	106.000		20.500
Shell Raffinaderi BV–Gothenburg	81.000		17.000
Skandinaviska Raffinaderi AB–			
Brofjorden-Lysekil	200.000	25.000	34.500
Total	**427.500**	**25.000**	**72.000**
SWITZERLAND			
Raffinerie de Cressier SA–Cressier	60.000		[1]16.000
Raffinerie du Sud-Ouest SA–			
Collombey	72.000		[1]10.000
Total	**132.000**	....	**26.000**
SYRIA			
Banias Refining Co.–Banias	126.350		[1]16.728
Homs Refinery Co.–Homs	[1]117.394		2.266
			[3]9.086
Total	**243.744**	....	**28.080**
TAIWAN,			
Chinese Petroleum Corp.–Kaohsiung	446.500	[1]23.750	[1]19.000
			[1]19.000
Tao-Yuan	123.500		[1]21.375
Total	**570.000**	**23.750**	**59.375**

WORLDWIDE REFINING	b cd Crude capacity	Catalytic cracking	Cat reforming
TANZANIA			
Tanzanian & Italian Petroleum Refining-CL-Kigamboni, Dar es Salaam	13,500		3,000
THAILAND			
Esso Standard Thailand Ltd.-Sriracha	73,000		8,600
Petroleum Authority of Thailand-Bangchak, Bangkok	61,750		9,450
Thai Oil CL-Sriracha	80,100	9,500	2,700
		6,200	
Total	214,850	15,700	20,750
TRINIDAD			
Trinidad and Tobago Oil CL-Pointe-a-Pierre	220,000	28,000	25,000
Point Fortin	80,000		6,000
Total	300,000	28,000	31,000
TUNISIA			
Ste. Tunisienne Industries des Raffinage-Bizerte	34,000		3,300
TURKEY			
Anadolu Tasfiyehanesi AS-Mersin	90,000		10,000
Turkish Petroleum Refineries Corp.			
Aliaga-Izmir	226,440	14,000	10,700
Batman-Siirt	24,350		1,300
Izmit	248,455	20,128	20,285
Kirikkale	112,849		20,342
Total	702,094	34,128	62,627
Solvent extraction: 11,700 b cd (furfural); 6,700 b cd (propane deasphalting)			
UNITED KINGDOM			
England			
Conoco Ltd.-South Killingholme	130,000	38,000	
		50,000	
Eastham Refinery Ltd.-Eastham, Cheshire	12,000		
Ellesmere Port	22,000		
Esso Petroleum CL-Fawley	300,200	76,500	27,900
			22,500
Lindsey Oil Refinery Ltd.-Killingholme, South Humberside	190,000	51,000	35,000
Mobil Oil CL-Coryton, Essex	145,000	47,000	32,000
Phillips Imperial Petroleum Ltd-Port Clarence	100,000		
Shell U.K. Ltd.-Shell Haven	92,000		32,000
Stanlow	262,000	59,000	29,000
			27,000
Total	1,253,200	321,500	205,400
Scotland			
BP Refinery Grangemouth Ltd.-Grangemouth	178,500	19,000	32,000
Briggs Oil Ltd.-Dundee	6,400		
Total	184,900	19,000	32,000
Wales			
Amoco UK Ltd.-Milford Haven	108,000	32,500	17,800
BP Refinery Llandarcy Ltd.-Llandarcy, Neath			
Gulf Oil GB-Milford Haven	105,000		18,000
Pembroke Cracking Co.-(65% Texaco 35% Gulf Oil GB)		86,000	
Texaco Ltd.-Pembroke, Dyfed	180,000		99,000
Total	393,000	118,500	74,800
Total United Kingdom	1,831,100	459,000	312,200
†Dimersol			

WORLDWIDE REFINING	b cd Crude capacity	Catalytic cracking	Cat reforming
URUGUAY			
Ancap-La Teja, Montevideo	33,000	4,100	2,500
U.S.S.R.			
Government-owned refineries at Achinsk, Angarsk, Baku, Batumi, Chimkent, Drogobych, Fergana, Gorki, Grozny, Guryev, Ishimba, Khabarovsk, Kherson, Kirishi, Komsomolsk, Krasnovodsk, Kremenchug, Kuibyshev, Lisichansk, Mazheikiai, Moscow, Mozyr, Nadvornaya, Nizhnekamsk, Odessa, Omsk, Orsk, Pavlodar, Perm, Polotsk, Ryazan, Saratov, Syzran, Tuapse, Ufa, Ukhta, Vannovskiy, Volgograd, and Yaroslavl			
Total	12,300,000		
VENEZUELA			
Corpoven-El Palito, Carabobo	105,000	45,000	6,000
El Toreno, Barinas	4,500		
Puerto La Cruz, Anzoategui	195,100	11,400	
San Roque, Anzoategui	5,200		
Lagoven-Judibana, Falcon	600,000	76,100	
Maraven-Punta Cardon, Falcon	291,300	60,600	
Total	1,201,100	193,100	6,000
VIRGIN ISLANDS			
Hess Oil Virgin Islands Corp.-St. Croix	545,000		125,000
Total	545,000		125,000
YEMEN, N.			
Yemen Hunt Oil Co.-Marib	10,000		2,500
YEMEN, S.			
Aden Refinery Co.-Little Aden	161,500		10,800
Solvent extraction: 7,920 b cd			
YUGOSLAVIA			
Bosanski Brod	112,835		7,612
			13,500
Lendava	14,600		
Novi Sad	63,000		8,200
Pancevo	108,000	20,750	8,800
Rijeka	160,000	21,300	17,500
Sisak	150,000	10,000	19,000
Zagreb	700		
Total	609,135	52,050	74,612
Solvent extraction: 3,300 b cd (deasphalting)			
ZAIRE			
Sozir, Muanda	17,000		3,500
ZAMBIA			
Indeni Petroleum Refinery CL, Bwanta Nkubwa Area, Ndola	24,500		5,600

U.S. refineries

Company and refinery location	Crude	Catalytic cracking	Catalytic reforming
ALABAMA			
Belcher Refining Co.-Mobile Bay	14,250		
Hunt Refining Co.-Tuscaloosa	45,000		6,000
Louisiana Land & Exploration Co.-Saraland	80,000		20,000
Total	139,250		26,000

Company and refinery location	Crude	Catalytic cracking	Catalytic reforming
ALASKA			
ARCO Alaska Inc.—Kuparuk	12,000		
Prudhoe Bay	16,000		
Chevron U.S.A. Inc.—Kenai	22,000		
Mapco Alaska Petroleum—North Pole	102,000		
Petro Star Inc.—North Pole	7,000		
Tesoro Petroleum Corp.—Kenai	72,000		†12,000
Total	**231,000**	.....	**12,000**
ARIZONA			
Intermountain Refining Co.—Fredonia	*5,710		
Sun Belt Refining Co.—Randolph	8,000		
Total	**13,710**	.....	.....
ARKANSAS			
Berry Petroleum Co.—Stevens	3,800		
Cross Oil & Refining Co. of Arkansas—Smackover	6,770		
Lion Oil Co.—El Dorado	48,000	†8,500	†9,000
Total	**58,570**	**18,500**	**9,000**

Solvent extraction: †5,500 b/d.

CALIFORNIA			
Anchor Refining Co Inc.—McKittrick	10,000		
Atlantic Richfield Co.—Carson	220,000	†82,000	48,000
Chemoil Refining Corp.—Signal Hill	14,200		
Chevron U.S.A. Inc.—El Segundo	286,000	†62,000	†51,000
Richmond	270,000	†63,000	†50,000
Conoco Inc.—Santa Maria	9,500		
Edgington Oil Co. Inc.—Long Beach	41,600		
Exxon Co.—Benicia	128,000	†64,000	†32,000
Fletcher Oil & Refining Co.—Carson	26,500	†12,000	†5,000
Golden Bear Division, Witco Chemical Corp.—Oildale	10,348		
Golden West Refining Co.—Santa Fe Springs	40,600	†13,500	†9,000
Huntway Refining Co.—Benicia	8,400		
Wilmington	5,500		
Kern Oil & Refining Co.—Bakersfield	20,000		†3,000
Lunday-Thagard Co.—South Gate	7,000		
Mobil Oil Corp.—Torrance	123,000	†63,000	†36,000
Pacific Refining Co.—Hercules	†52,250		†15,000
Paramount Petroleum Corp.—Paramount	42,700		†10,500
Powerine Oil Co.—Santa Fe Springs	46,550	†12,500	†9,000
San Joaquin Refining Co.—Bakersfield	18,000		
Shell Oil Co.—Martinez	140,100	†67,000	†28,000
Wilmington	139,000	†42,000	†24,000
Sunland Refining Corp.—Bakersfield	15,000		†1,500
Tenby, Inc.—Oxnard	4,000		
Texaco Refining & Marketing Inc. Bakersfield	48,000		†22,000
Wilmington	75,000	†28,000	†38,000
Tosco Corp.—Martinez	141,900	†60,000	†20,000
			†23,000
Ultramar, Inc.—Wilmington	68,000	†38,000	†14,500
Unocal Corp.—Los Angeles	108,000	†47,000	†52,000
Rodeo	113,100		†34,000
Total	**2,222,248**	**645,000**	**535,500**

Solvent extraction: †50,000 b/sd.
†FCC plant down due to fire. Rebuilt unit scheduled on line July 1991.

COLORADO			
Colorado Refining Co.—Commerce City	28,000	†8,500	†9,000
Conoco Inc.—Denver	48,000	†17,000	†10,000
Western Slope Refining Co.	15,200		†3,400
Total	**91,200**	**25,500**	**22,400**
DELAWARE			
Star Enterprise—Delaware City	140,000	†65,000	†18,000
Total	**140,000**	**65,000**	**56,000**
GEORGIA			
Amoco Oil Co.—Savannah	28,000		
Young Refining Corp.—Douglasville	7,500		
Total	**35,500**	.....	.....
HAWAII			
Chevron U.S.A. Inc.—Barber's Point	52,800	†20,000	
Hawaiian Independent Refinery Inc.—Ewa Beach	77,000		†12,000
Total	**129,800**	**20,000**	**12,000**

†Dimersol.

ILLINOIS			
Clark Oil & Refining Corp.—Blue Island	64,600	†25,000	†30,500
Hartford	60,000	†26,000	†12,000
Marathon Petroleum Co.—Robinson	195,000	†42,000	†38,000
			†41,000
Mobil Oil Corp.—Joliet	180,000	†38,000	†46,000
Shell Oil Co.—Wood River	274,000	†44,000	†18,000
			†75,000
Unocal Corp.—Lemont	147,000	†58,000	†29,800
Total	**920,600**	**343,000**	**292,300**
INDIANA			
Amoco Oil Co.—Whiting	350,000	†140,000	†85,000
Indiana Farm Bureau Cooperative Association Inc.—Mt. Vernon	20,600	†7,000	†4,000
Laketon Refining Corp.—Laketon	8,300		
Marathon Petroleum Co. Indianapolis	48,000	†19,500	†10,500
Total	**426,900**	**166,500**	**99,500**

Solvent extraction: †4,500.

KANSAS			
Coastal Refining and Marketing Inc.—Augusta			†10,000
Derby Refining Co.—El Dorado	†30,400	†4,500	†4,500
Wichita	†29,925	†9,000	†6,500
Farmland Industries Inc.—Coffeyville	56,500	†23,000	†16,000
Phillipsburg	26,400		†5,300
National Cooperative Refinery Association—McPherson	70,900	†20,000	†15,000
Texaco Refining & Marketing Inc. El Dorado	†8,000	†3,500	†8,500
Total Petroleum Inc.—Arkansas City	56,000	†9,500	†8,000
Total	**348,125**	**127,500**	**93,800**

Solvent extraction: †4,500 b/sd.

KENTUCKY			
Ashland Petroleum Co.—Catlettsburg	†73,400	†60,000	†25,000
		†40,000	
Somerset Refinery Inc.—Somerset	5,500		†1,000
Total	**218,900**	**100,000**	**53,000**

†ART. §Reduced crude throughput.

LOUISIANA			
Atlas Processing Co., Division of Petrozol—Shreveport	46,500		†10,000
Calcasieu Refining Co.—Lake Charles	†2,400		
Calumet Refining Co.—Princeton	†4,500		
Canal Refining Co.—Church Point	†9,865		†1,900
Citgo Petroleum Corp.—Lake Charles	320,000	†150,000	†80,000
			†45,000
Conoco Inc.—Lake Charles	†94,500	†42,500	†16,000
			†12,000
Exxon Co.—Baton Rouge	†221,000	†88,000	†60,000
Hill Petroleum Co.—Krotz Springs	†2,400	†3,000	†2,500
St. Rose	†40,000		
Kerr-McGee Refining Corp. Cotton Valley	†7,800		
Marathon Petroleum Co.—Garyville	†55,000	†20,000	†8,000
Mobil Oil Corp.—Chalmette	†60,000	†55,000	†28,000
			†14,000

Company and refinery location	Crude	Catalytic cracking	Catalytic reforming
Murphy Oil USA Inc.—Meraux	92,500	[1]35,000	[2]23,000
Placid Refining Co.—Port Allen	47,500	[1]19,000	[1]10,000
Shell Oil Co.—Norco	215,000		[2]18,000
			[3]38,000
Sohio Oil Co.(BP America)—Belle Chasse	[4]194,750	[1]89,000	[1]37,500
Star Enterprise—Convent	225,000	[1]85,000	[1]40,000
Total	**2,687,915**	**783,500**	**494,900**

[1]Solvent extraction [2]6,900 b/sd [3]12,000 b/sd [4]6,000 b/sd [5]30,000 b/sd

MICHIGAN

Crystal Refining Co.—Carson City	4,000		
Lakeside Refining Co.—Kalamazoo	5,600		[1]1,000
Marathon Petroleum Co.—Detroit	68,500	[1]27,000	[1]18,500
Total Petroleum Inc.—Alma	45,600	[1]19,500	[1]14,000
Total	**123,700**	**46,500**	**33,500**

[1]Etherification MTBE 1,100

MINNESOTA

Ashland Petroleum Co.—St. Paul Park	67,100	[1]23,000	[1]23,500
Koch Refining Co.—Rosemount	[2]218,500	[1]55,000	[1]26,000
			[3]6,000
Total	**285,600**	**78,000**	**55,500**

[1]Dimersol

MISSISSIPPI

Amerada Hess Corp.—Purvis	30,000	16,000	[1]5,800
Chevron U.S.A. Inc.—Pascagoula	295,000	[2]58,000	[3]90,000
Ergon Refining Inc.—Vicksburg	16,800		
Southland Oil Co.—Lumberton	5,800		
Sandersville	11,000		
Total	**358,600**	**74,000**	**95,800**

MONTANA

Cenex—Laurel	40,400	[1]12,000	[1]12,000
Conoco Inc.—Billings	49,500	[1]18,500	[1]14,700
Exxon Co.—Billings	42,000	[1]21,000	10,000
Montana Refining Co.—Great Falls	7,000	[1]2,400	[1]1,000
Total	**138,900**	**53,900**	**37,700**

[1]Solvent extraction [2]4,000 b/sd [3]7,500 b/sd (PDA)

NEVADA

Nevada Refining Co.—Tonopah	4,500	.....	.....

NEW JERSEY

Amerada Hess Corp.—Port Reading		[1]50,000	
Chevron U.S.A. Inc.—Perth Amboy	80,000		
Coastal Eagle Point Oil Co.—Westville	[2]109,250	[1]50,000	[1]27,000
Exxon Co.—Linden	130,000	120,000	[1]28,000
Mobil Oil Corp.—Paulsboro	100,000	[1]36,000	[1]23,500
Seaview Petroleum Co. L.P.—Thorofare	75,000		
Total	**494,250**	**256,000**	**78,500**

[1]Solvent extraction [2]9,500 b/sd [3]Cumene
[4] Distallation

NEW MEXICO

Bloomfield Refining Co.—Bloomfield	16,800	[1]6,000	[1]4,000
Giant Industries Inc.—Gallup	19,000	[1]7,200	6,800
Navajo Refining Co.—Artesia	[2]38,000	[3]14,500	[1]7,800
Thriftway Marketing Corp.—Farmington	6,500		[1]2,500
Total	**80,300**	**27,700**	**21,100**

NEW YORK

Cibro Petroleum Products Co.—Albany	[1]42,500	.....	.....

Company and refinery location	Crude	Catalytic cracking	Catalytic reforming
NORTH DAKOTA			
Amoco Oil Co.—Mandan	58,000	[1]26,000	[2]12,100
Total	**58,000**	**26,000**	**12,100**

OHIO

Ashland Petroleum Co.—Canton	66,000	25,000	[1]20,000
Sohio Oil Co.(BP America)—Lima	[2]171,000	36,000	[3]53,000
	6,900		
	[4]16,600		
Toledo	[2]120,650	55,000	[1]23,000
			[4]19,000
Sun Refining & Maketing Co.—Toledo	125,000	60,000	[5]45,600
Total	**482,650**	**176,000**	**160,600**

[1]Solvent extraction [2]9,000 b/sd

OKLAHOMA

Barrett Refining Corp.—Thomas	13,000		
Conoco Inc.—Ponca City	140,000	53,000	[1]36,000
Kerr-McGee Refining Corp.—Wynnewood	43,000	20,000	8,500
Sinclair Oil Corp.—Tulsa	50,000	18,000	12,000
Sun Refining & Marketing Co.—Tulsa	85,000	30,000	24,000
Total Petroleum Inc.—Ardmore	60,500	23,500	[2]14,000
Total	**391,500**	**144,500**	**94,500**

[1]Solvent extraction [2]5,000 b/sd [3]5,800 b/sd

OREGON

Chevron U.S.A. Inc.—Portland	15,000		

PENNSYLVANIA

Atlantic Refining & Marketing Corp.			
Philadelphia	125,000	[1]29,000	60,000
Chevron U.S.A. Inc.—Philadelphia	175,000	[2]53,300	34,000
Pennzoil Products Co.—Rouseville	15,700		[3]5,820
Quaker State Oil Refining Corp.			
Smethport	6,500		[1]2,100
Sohio Oil Co.(BP America)—Marcus Hook	[4]171,000	[1]50,000	[1]48,000
Sun Refining & Marketing Co.			
Marcus Hook	165,000	[1]87,000	[1]39,600
Philadelphia	125,000	[1]29,000	[1]50,000
United Refining Co.—Warren	[5]64,600	20,000	16,000
Witco Chemical Co.—Bradford	8,200		3,300
Total	**856,000**	**268,300**	**258,820**

[1]Solvent extraction [2]730 b/sd

TENNESSEE

Mapco Petroleum Inc.—Memphis	60,000	30,000	10,000
Total	**60,000**	**30,000**	**10,000**

TEXAS

Amoco Oil Co.—Texas City	415,000	195,000	[1]160,000
Champlin Refining Co.—Corpus Christi	135,000	[2]70,000	[3]52,000
Chevron U.S.A. Inc.—El Paso	66,000	[2]22,000	[2]25,000
Port Arthur	329,000	[2]110,000	[2]23,000
			[4]44,100
Coastal Refining & Marketing Inc.			
Corpus Christi	[5]90,250	[2]18,500	[2]11,000
			[2]7,500
Crown Central Petroleum Corp.—Houston	100,000	56,000	14,000
			[2]22,000
Diamond Shamrock Corp.—Sunray	110,000	[1]45,000	[2]29,000
Three Rivers	50,000	20,000	11,000
El Paso Refining Co. Ltd.—El Paso	26,000	10,800	6,700
Exxon Co. U.S.A.—Baytown	426,000	170,000	60,000
			[2]63,000
Fina Oil & Chemical Co.—Big Spring	55,000	[1]22,000	20,000
Port Arthur	110,000	36,000	44,000
Hill Petroleum Co.—Houston	66,000	50,000	13,500
Texas City	123,000	50,000	11,000
			[1]12,000
Howell Hydrocarbons Inc.—San Antonio	2,900		[1]1,200
Koch Refining Co.—Corpus Christi	125,000	40,000	[1]15,000
			[2]33,500

Company and refinery location	Crude	Catalytic cracking	Catalytic reforming
LaGloria Oil & Gas Co.: Tyler	49,500	[1]17,000	[2]4,000 [3]11,700
Liquid Energy Corp.: Bridgeport	10,000		
Lyondell Petrochemical Co.: Houston	265,000	[4]90,000	[5]110,000
Marathon Petroleum Co.: Texas City	69,500	[6]38,000	[7]10,000
Mobil Oil Corp.: Beaumont	275,000	[8]102,000	[9]57,000 46,000
Phillips 66 Co.: Borger	105,000	[10]60,000	[11]26,000
Sweeny	175,000	[12]87,000	[13]36,000
Pride Refining Inc.: Abilene	44,100		
Shell Oil Co.: Deer Park	215,900	[14]65,000	[15]20,000 [16]43,000
Odessa	28,600	[17]10,500	[18]10,000
Southwestern Refining Co.: Corpus Christi	104,000	[19]50,000	[20]30,000
Star Enterprise: Port Arthur	[21]250,000	[22]110,000	[23]42,000
Trifinery: Corpus Christi	[24]27,000		
Unocal Corp.: (Beaumont); Nederland	120,000	[25]39,000	[26]12,000 [27]20,000
Valero Refining Co.: Corpus Christi	25,000	[28]65,000	
Total	**3,992,750**	**1,588,300**	**1,156,200**

[1]15,000 b/sd; [2]7,000 b/sd; [3]53,000 b/sd; [4]10,000 b/sd; [5]18,000 b/sd; [6]11,000 b/sd; [7]6,000 b/sd.
[8]Heavy oil cracker; [9]Dimersol; [10]MTBE.

UTAH

Amoco Oil Co.: Salt Lake City	40,000	[1]18,000	[2]7,600
Big West Oil Co.: Salt Lake City	24,000	[3]5,000	[4]5,000
Chevron U.S.A.: Salt Lake City	45,000	[5]11,000 [6]7,000	[7]7,500
Crysen Refining Inc.: Woods Cross	12,500		[8]3,000
Pennzoil Products Co.: Roosevelt	8,000	[9]6,000	[10]2,000
Phillips 66 Co.: Woods Cross	25,000	[11]8,400	[12]6,000
Total	**154,500**	**55,400**	**31,100**

[1]5,000 b/sd.

VIRGINIA

Amoco Oil Co.: Yorktown	53,000	[1]27,500	[2]10,200
Total	**53,000**	**27,500**	**10,200**

WASHINGTON

Atlantic Richfield Co.: Ferndale	164,000		[1]56,000
Chevron U.S.A. Inc.: Seattle	[2]5,000		
Shell Oil Co.: Anacortes	85,000	[3]42,000	[4]25,000
Sohio Oil Co. (BP America): Ferndale	77,000	25,500	[5]11,800
Sound Refining Inc.: Tacoma	11,900		
Texaco Refining & Marketing Inc.: Anacortes	117,000	[6]45,000	[7]7,000 [8]14,000
U.S. Oil & Refining Co.: Tacoma	[9]32,775		[10]6,000
Total	**492,675**	**112,500**	**119,800**

[1]4,500 b/sd.

WEST VIRGINIA

Phoenix Refining Co.: St. Mary's	19,180		1,500
Quaker State Oil Refining Corp.: Newell	10,500		[1]3,400
Total	**29,680**		**4,900**

[1]900 b/sd.

WISCONSIN

Murphy Oil USA Inc.: Superior	32,000	11,000	8,000

WYOMING

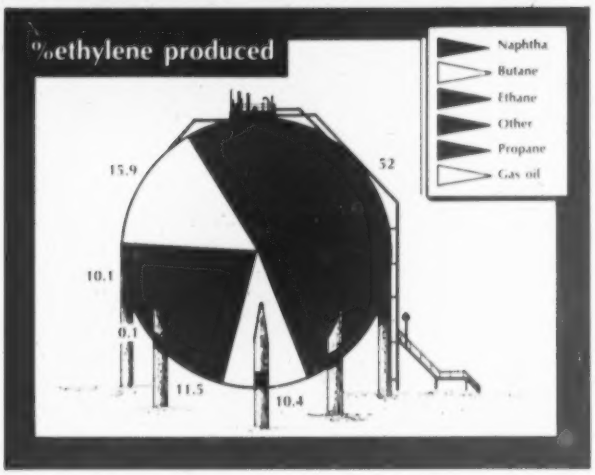
Amoco Oil Co.: Casper	40,000	[1]13,500	[2]7,000
Frontier Oil & Refining Co.: Cheyenne	36,100	[3]12,000	[4]7,000
Little America Refining Co.: Evansville	22,000	[5]14,000	[6]6,000
Sinclair Oil Corp.: Sinclair	54,000	[7]21,000	[8]14,500
Wyoming Refining Co.: Newcastle	12,500	[9]4,000	[10]2,750
Total	**164,600**	**64,500**	**37,250**

UNITED STATES

Survey of operating refineries in the U.S. (state capacities as of January 1, 1990)

State	No. plants	Crude capacity b cd	Cat cracking Fresh feed	Cat reforming
Alabama	3	139,250		26,000
Alaska	6	231,000		12,000
Arizona	1	13,710		
Arkansas	3	58,570	18,500	9,000
California	31	2,222,248	645,000	535,500
Colorado	3	91,200	25,500	22,400
Delaware	1	140,000	65,000	56,000
Georgia	2	35,500		
Hawaii	2	129,800	20,000	12,000
Illinois	6	920,600	343,000	292,300
Indiana	4	426,900	166,500	99,500
Kansas	8	348,125	127,500	93,800
Kentucky	2	218,900	100,000	53,000
Louisiana	17	2,687,915	783,500	494,900
Michigan	4	123,700	46,500	33,500
Minnesota	2	285,600	78,000	55,500
Mississippi	5	358,600	74,000	95,800
Montana	4	137,200	50,600	35,500
Nevada	1	4,500		
New Jersey	6	494,250	256,000	78,500
New Mexico	3	80,300	27,700	21,100
New York	1	42,500		
North Dakota	1	58,000	26,000	12,100
Ohio	4	482,650	176,000	160,600
Oklahoma	6	391,500	144,500	94,500
Oregon	1	15,000		
Pennsylvania	8	856,000	268,300	258,820
Tennessee	1	57,000	30,000	10,000
Texas	31	3,992,750	1,588,300	1,156,200
Utah	6	154,500	55,400	31,100
Virginia	1	53,000	27,500	10,200
Washington	7	492,675	112,500	119,800
West Virginia	2	29,680		4,900
Wisconsin	1	32,000	11,000	8,000
Wyoming	5	164,600	64,500	37,250
Total	**190**	**15,951,023**	**5,324,600**	**3,931,970**

Feedstock demand, 1988 to 1994



continue to be a significant feedstock, especially in North America, but incremental supplies at attractive prices are likely to be limited in the Gulf Coast region where a large amount of capacity addition is planned.

As a result, naphtha, gas oil, and LPG feeds will gain in importance worldwide.

Naphtha, an important feedstock in Europe and the Far East will be in higher demand during the 1990s. By 1994, petrochemical demand for naphtha will be about 90 million metric tons year. Most of the growth in demand will be in the U.S., Far East, and Latin America.

Gas oil as an olefin plant feed is primarily limited to plants in the U.S. and Europe. And the world balance for middle distillates is relatively tight.

Therefore, gas oil cracking is limited to those integrated complexes (a facility with both a refinery and petrochemical plant) where naptha and gas oil stream quantities can be balanced with fuels and petrochemical production needs. Olefin demand for gas oil feed is expected to reach about 25 milion metric tons year in 1994.

LPG is gaining in importance as an ethylene feed. But shipping and distribution problems will need to be addresse before LPG is widely accepted as an olefin feedstock. Petrochemical feedstock demand for butane is slated to rise to about 18 million metric tons year by 1994, and propane about 15 million metric tons year. Fig. 2 shows the distribution of feedstocks, in percent of ethylene produced, of the various feedstocks.

Recycled plastics

Growing public concern that plastics do not biodegrade when disposed of in land fills, has spurred moves to restrict or even ban the use of plastics in packaging, such as bottles and bags. Another alternative to restrictions is recycling of the plastic products for re-use in similar products.

Whether the use of plastics is restricted, or if the products are recycled, there could be significant reduction in demand for them.

Other approaches to the problem include plastic products that degrade over time when placed in land fills, and burning them in power plants.

Petrochemical producers favor recycling over other alternatives because recycling maintains markets, uses available technology, and is economical. Several petrochemical producers and waste management companies have formed joint ventures to recycle plastics.

Table 1

Ethylene capacity by country*

Area	1,000 metric tons year 1987	1988	1989
North America			
U.S.	16,820	16,985	17,786
Canada	2,200	2,358	2,407
Total	**19,020**	**19,343**	**20,193**
Latin America			
Argentina	254	256	262
Bolivia	230	230	230
Brazil	1,461	1,502	1,573
Chile	60	60	60
Colombia	115	200	215
Mexico	932	932	932
Puerto Rico	413	413	413
Venezuela	150	150	150
Total	**3,615**	**3,742**	**3,835**
Western Europe			
Austria	320	320	320
Belgium	520	520	520
Finland	200	230	230
France	2,400	2,435	2,455
West Germany	3,790	3,790	3,790
Greece	15	15	15
Italy	1,485	1,845	1,845
The Netherlands	2,285	2,325	2,360
Norway	390	390	390
Portugal	300	300	300
Spain	966	966	980
Sweden	365	355	370
Switzerland	30	30	30
U.K.	1,845	1,945	1,975
Total	**14,911**	**15,466**	**15,580**
Asia Pacific			
Australia	420	420	455
India	256	256	257
Japan	5,357	4,295	4,458
Korea	505	505	505
Singapore	300	300	300
Taiwan	953	953	953
Total	**7,791**	**6,729**	**6,928**
Other			
Algeria	364	364	364
Hungary	—	250	250
Iran	26	26	26
Israel	130	130	130
Qatar	280	280	300
Saudi Arabia	1,611	1,611	1,611
South Africa	150	220	320
Syria	—	250	250
Turkey	355	355	355
Total	**2,916**	**3,486**	**3,606**
World Total	**48,295**	**48,766**	**50,142**

*As of June 1, 1989.

Plastics that are considered recycleable include: polyethylene, polystyrene, polypropylene, polyethylene terephthalate, and polyvinyl chloride. These products account for nine of the ten plastics sold.

One example is the joint venture, Polystyrene Recycling Inc. (Amoco Corp., McDonald's Corp., and wTe Corp.), recently opened a polystyrene foam recycling plant in Brooklyn, N.Y.

The 1 million lb year plant separates polystryrene wastes that are shredded, cleaned, and pelletized, and sends its product to a plant that reuses the material for foundation protection board.

Technology exists to make plastics that biodegrade in land fills. Three technologies that exist include: aliphatic

Table 2

Some of the major ethylene projects planned

	Capacity expansion 1,000 metric tons year	Estimated start date
U.S.A.		
Cain Chemical Co.	453.5	1993
Chevron Chemical Co.	90.7	1989
Dow Chemical Co.	680.3	1992
Exxon Chemical Co.	453.5	1990
Formosa Plastics Group	680.3	1992
Lyondell Petrochemical Co.	272.1	1989
Mobil Chemical Co.	453.5	—
Phillips 66 Co.	680.3	1991
Quantum Chemical Corp.	680.3	1991
Shell Chemical Co.	453.5	1991
Texaco Chemical Co.*	181.4	1989
Union Carbide Corp.*	226.8	1989
Union Texas Petroleum Corp.	181.4	1990
Vista Chemical Co.	181.4	1990
Westlake Petrochemicals Corp.	453.5	1991
Total estimated U.S. additions	**6,122.5**	
SOUTH KOREA		
Daelim	300.0	1989
Yukong	400.0	1989
Lucky	350.0	1992
Others (6)	1,300.0	1995
TAIWAN		
China Petroleum	400.0	1992
Formosa Plastics	400.0	?
THAILAND		
Thai National Petrochemical Co.	315.0	1990
Thai National Petrochemical Co.	315.0	1995
JAPAN		
Restarts	445.0	1992
New cracker	400.0	1993
INDIA		
Nagothane	300.0	1990
Madras	300.0	1991
INDONESIA		
Several studies	300.0	1993
MAYLASIA		
Several contenders	300.0	1993
CHINA		
Shanghai	300.0	1990
AUSTRALIA		
Petrochem Ind. Ltd.	145.0	1991
EGYPT		
Egyptian Petrochemical Co.	200.0	1991
IRAN		
National Petrochemical Co.	490.00	1993
IRAQ		
Iraq Petrochemical Co.	600.0	1993
KUWAIT		
Kuwait Petrochemical Co.	285.0	?
NIGERIA		
Element Petrochemical Co.	400.0	1992
SAUDI ARABIA		
Sabic/Shell	300.0	1990
Petrokemya	500.0	1993
Sabic/Mobil	500.0	1993
Total Far East and Mid East	**9,545.0**	

*Restarts of existing facilities.
Source: DeWitt & Co.

Table 3

Estimated world styrene capacity, 1989

Producer	Estimated capacity 1,000 metric tons year
U.S.	
Amoco Chemical Co., Texas City, Tex.	345
ARCO, Channelview, Tex.	630
ARCO, Kobuta, Pa.	100
Chevron Chemical Co., Donaldsonville, La.	270
Cosmar Chemicals, Carville, La.	680
Dow Chemical Co., Freeport, Tex.	590
El Paso Products Co., Odessa, Tex.	145
Huntsman Petrochemical Co., Bayport, Tex.	450
Sterling Chemical Co., Texas City, Tex.	680
Total U.S.	**3,890**
CANADA	
Dow Chemical Canada Inc., Sarnia, Ont.	65
Polysar Ltd., Sarnia, Ont.	365
Shell Canada Ltd., Scotford, Alta.	360
Total Canada	**790**
WESTERN EUROPE	
Atochem, Gonfreville, France	250
Atochem, Lacq, France	25
BP Chemicals Ltd., Baglan Bay, U.K.	220
BASF AG, Ludwigshafen, West Germany	500
BASF AG, Wesseling, West Germany	380
Dow Chemical (Nederland) BV, Terneuzen, The Netherlands	770
Enimont, Ravenna, Italy	45
Enimont, Mantua, Italy	280
Hüls, Marl, West Germany	250
Norsolor, Caring, West Germany	300
Repsol, Puertollano, Spain	110
Shell Nederland Chemie BV, Moerdijk, The Netherlands	320
Total Western Europe	**3,450**
OTHER REGIONS	
Japan	1,785
Taiwan	340
Korea	230
China	200
Latin America	560
Others	1,805
Total other regions	**4,920**
Total world	**13,050**

Source: BASF AG and Grand Pacific Petrochemical Corp., June 1, 1989.

polyester compounds, adding starch to olefinic and styrenic copolymers, and adding starch and auto-oxidant to similar polymers.

Unfortunately, land fills are designed to minimize biodegradation. And some of the technologies used to make the plastic biodegradeable require ultra-violet radiation (sunlight) to cause the degradation.

There is also the possibility of using the waste plastic as fuel in power plants.

Polyethylene, for instance, provides 43,600 BTU kg vs. 41,700 BTU kg for heating oil.

But getting permits to allow plants to burn waste plastic may be a big problem because of the possibility of toxic byproducts. IPE